National Marine Fisheries Service
Endangered Species Act (ESA) Section 7 Consultation
Biological Opinion and Magnuson-Stevens Act Essential Fish Habitat Consultation

Action Agency:	National Marine Fisheries Service
Species/ESU Affected:	Lower Columbia River chinook salmon *(Oncorhynchus tshawytscha*) Columbia River chum salmon (*O. keta*) Lower Columbia River steelhead (*O. kisutch*)
Activities Considered:	National Marine Fisheries Service's determination regarding five proposed Fisheries Management Evaluation Plans (FMEP) submitted by the Washington Department of Fish and Wildlife and the Oregon Department of Fish and Wildlife under ESA 4(d) Rule limit 4.
Consultation Conducted by:	The Salmon Recovery Division, Northwest Region, National Marine Fisheries Service Consultation Number: F/NWR/2003/00482

This document constitutes NOAA's National Marine Fisheries Service's (NMFS) biological opinion for proposed Federal actions that are likely to affect the listed Lower Columbia River (LCR) chinook salmon, LCR steelhead, and Columbia River chum salmon Evolutionarily Significant Units (ESU). The Federal action is NMFS' ESA 4(d) Rule approval of the submitted FMEPs. NMFS concludes that this action is not likely to jeopardize the continued existence of the LCR ESUs. NMFS further determines that EFH for Pacific salmon will be adversely affected by the proposed fisheries, and that implementation measures described in the Evaluation and Recommended Determination document be adopted as the EFH conservation measures.

This Opinion has been prepared in accordance with section 7 of the Endangered Species Act (ESA) of 1973 as amended (16 U.S.C. 1531 *et seq*.). It is based on information provided in FMEPs submitted to NMFS, NMFS' ESA 4(d) Rule Limit 4 Evaluation and Recommended Determination documents prepared for the FMEPs, published and unpublished scientific information on listed salmon and steelhead in the action area, and other sources representing the best available scientific information. A complete administrative record of this consultation is on file with the Salmon Recovery Division, Portland, Oregon.

D. Robert Lohn

D. Robert Lohn
Regional Administrator

10/29/03
Date

Attachments

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1. CONSULTATION HISTORY

This document constitutes NOAA's National Marine Fisheries Service's (NMFS) Biological Opinion (Opinion) for proposed Federal actions that are likely to affect the listed Lower Columbia River (LCR) chinook salmon, LCR steelhead and Columbia River (CR) chum salmon Evolutionarily Significant Units (ESU). The Federal actions (described below) are NMFS' ESA 4(d) Rule determinations regarding a Fisheries Management and Evaluation Plan (FMEP) submitted by the Washington Department of Fish and Wildlife (WDFW) and four FMEPs submitted by the Oregon Department of Fish and Wildlife (ODFW) (Table 1). This Opinion has been prepared in accordance with section 7 of the Endangered Species Act (ESA) of 1973 as amended (16 U.S.C. 1531 *et seq*). It is based on information provided in the FMEPs (ODFW 2000; 2001a; 2001b; ODFW 2003; and WDFW 2003) prepared under NMFS' ESA section 4(d) Rule for threatened salmonids (50 CFR 223.203), NMFS' ESA 4(d) Rule Limit 4 Evaluation and Recommended Determination (ERD) documents prepared for the FMEPS (NMFS 2003a; 2003b; 2003c; 2003d; 2003e (attached)), published and unpublished scientific information on listed Lower Columbia River salmon and steelhead in the action area, and other sources of information. A complete administrative record of this consultation is on file with NMFS' Salmon Recovery Division, Portland, Oregon.

NMFS' ESA section 4(d) Rule for 14 threatened salmonid ESUs contains a "fisheries harvest activities" limit that provides that the prohibitions of section 9(a)(1) of the ESA do not apply to fisheries harvest activities that adequately address the criteria of that limit (50 CFR 223.203(b)(4)) (65 FR 42422, July 10, 2000). The WDFW and ODFW have submitted FMEPS for consideration under the 4(d) Rule (Table 1). The FMEPs will affect the threatened LCR chinook salmon, LCR steelhead, and CR chum salmon ESUs in the States of Washington and Oregon. WDFW submitted one FMEP that addresses fisheries impacts on all three ESUs while ODFW has submitted individual FMEPs that address impacts on the separate ESUs. The Hood River steelhead fisheries were submitted in a separate FMEP (see Table 1).

NMFS is consulting with itself under section 7 on the Federal action of rendering a determination regarding whether or not the proposed FMEPs adequately address ESA 4(d) Rule Limit 4 criteria, and so whether limitations on the application of section 9 take prohibitions are warranted.

Table 1. Fisheries management and evaluation plans considered in this opinion.

Submitting Agency	Plan
Washington Department of Fish and Wildlife	Fisheries Management and Evaluation Plan. Lower Columbia River (WDFW 2003).
Oregon Department of Fish and Wildlife	• Fisheries Management and Evaluation Plan. Lower Columbia River Chinook Salmon in Oregon Freshwater Fisheries of the Lower Columbia River Mainstem and Tributaries Between the Pacific Ocean and Hood River (ODFW 2003). • Fisheries Management and Evaluation Plan. Lower Columbia River ESU Steelhead, Trout, Sturgeon and Warmwater Fisheries Lower Columbia River Mainstem Tributaries, Lower Willamette River Tributaries, Clackamas River and the Sandy River (ODFW 2001a). • Fisheries Management and Evaluation Plan. Lower Columbia River Chum Salmon in Oregon Freshwater Fisheries of the Lower Columbia River Mainstem and Tributaries Between the Pacific Ocean and Bonneville Dam (ODFW 2001b). • Fisheries Management and Evaluation Plan. Hood River Basin Steelhead, Trout and Salmon Fisheries (ODFW 2000).

2. PROPOSED ACTION AND ACTION AREA

Following *Endangered Species Act Consultation Handbook* guidelines (USFWS and NMFS 1998), the fisheries harvest activities implemented under the FMEPs are considered likely to adversely affect listed LCR salmon and steelhead. The FMEPs cover fisheries in the tributaries to the Columbia River downstream of and including the Wind River in Washington and the Hood River in Oregon, excluding those fisheries in the Willamette River above Willamette Falls. The FMEPs exclude those mainstem Columbia River fisheries managed under *U.S. v. Oregon* and ocean fisheries that may encounter fish from the LCR ESUs. The mainstem Columbia River fisheries undergo section 7 consultation initiated by the parties to *U.S. v. Oregon*, and the ocean fisheries undergo section 7 consultation initiated by the Pacific Fisheries Management Council (PFMC).

The tributary fisheries in the FMEPs primarily target returning hatchery produced salmon and steelhead, but also includes fisheries for non-salmonid species. The recreational sport fisheries employ hook and line fishing methods and my permit either natural bait or artificial lures. Fishing regulations established in the FMEPs regulate the method (e.g., gear, bait, size limit, bag limit), the areas open to fisheries, timing of the fisheries and the species that can be targeted by the recreational fisheries. All hatchery-produced steelhead, spring chinook salmon, and coho salmon released in the areas covered by the FMEPs are externally marked to allow for selective harvest of hatchery produced fish. In areas where naturally produced fish are present, recreational fisheries are managed with the requirement that all unmarked adult salmon and steelhead be released. Only adipose fin-clipped adult salmon and steelhead may be retained in the fisheries. In areas where naturally produced fish are not listed, recreational salmon fisheries can harvest marked and unmarked adult salmon which are managed to meet hatchery broodstock and natural production escapement goals.

The exception to the selective fisheries management regime are the fisheries for tule fall chinook. Only a small portion of the hatchery-produced fall chinook salmon are externally marked, limiting the potential for selective fisheries based on marked capture-and-live-release. Tributary fisheries for fall chinook salmon are therefore managed to meet escapement goals for naturally produced populations and to meet hatchery broodstock needs. All fisheries impacts on LCR tule fall chinook salmon from ocean, mainstem Columbia River, and tributary fisheries are managed to not exceed a Rebuilding Exploitation Rate (RER) established by NMFS. The RER was developed to provide for the recovery of LCR tule fall chinook salmon when managing ocean fisheries under the Pacific Fisheries Management Council and is also used to manage lower Columbia River mainstem commercial and recreational fisheries. Tributary fisheries proposed in the FMEPs can be open year around but tend to be closed both seasonally and by area to protect non-target natural spawning populations and out migrating juvenile salmon and steelhead. All fisheries are described in detail within the FMEPs (ODFW 2000; 2001a; 2001b; ODFW 2003; and WDFW 2003) and in the ERD documents (NMFS 2003a; 2003b; 2003c; 2003d; and 2003e). The FMEPs also provide details on monitoring and evaluation activities that are designed to measure the status of listed populations within the management areas and measure harvest and fisheries. The monitoring and evaluation information will be provided to NMFS in annual reports and the FMEPs will be evaluated every five years to determine if objectives are being accomplished. The FMEPs also describe the level of take anticipated. NMFS' evaluation of the FMEPs for compliance with ESA 4(d) Rule Limit 4 criteria provides further discussion of the proposed harvest activities (NMFS 2003a; 2003b; 2003c; 2003d; and 2003e).

The action area for this consultation is the geographical boundary of the Lower Columbia River chinook salmon ESU (64 FR 14308, March 25, 1999) in the States of Washington and Oregon (Figure 1). The area of the LCR chinook ESU also encompasses the areas occupied by the CR chum salmon and LCR steelhead. As described above, the FMEPs describe management of fisheries in the tributaries to the Columbia River downstream of and including the Wind River in Washington and the Hood River in Oregon, excluding those fisheries in the Willamette River above Willamette Falls. The specific areas for each fishery under the FMEPs are defined within the FMEPs and summarized in the NMFS ERD documents (Attachment 1).

3. STATUS OF THE SPECIES AND CRITICAL HABITAT

The FMEPs (ODFW 2000; 2001a; 2001b; ODFW 2003; and WDFW 2003) and the NMFS 4(d) Rule ERD documents (NMFS 2003a; 2003b; 2003c; 2003d; and 2003e) contain currently available information about the status of the LCR salmon and steelhead ESUs. Critical habitat was designated and described in detail, for these ESUs, in the February 16, 2000, *Federal Register* notice (65 FR 7764). On April 30, 2002, the U.S. District Court for the District of

Columbia approved a NMFS consent decree withdrawing the February 2000 critical habitat designation for these ESUs. However, the analysis and conclusions regarding critical habitat remain informative for NOAA Fisheries' application of the jeopardy standard. Essential features of the adult spawning, juvenile rearing, and adult and juvenile migratory habitat for LCR salmon and steelhead are: (1) substrate; (2) water quality; (3) water quantity; (4) water temperature; (5) water velocity; (6) cover/shelter; (7) food (juvenile only); (8) riparian vegetation; (9) space; and (10) safe passage conditions (50 CFR 226). The FMEPs do not propose to conduct activities that will disrupt habitat. When implemented, the proposed fisheries under the FMEPs are not expected to affect any of the essential habitat features for the listed LCR ESUs.

The regulations in the ESA 4(d) Rule state that an FMEP must use the concepts of viable and critical thresholds as defined in the NMFS Viable Salmonid Population (VSP) document (McElhany *et al.* 2000). Application of these VSP concepts is needed to adequately limit take of listed salmon and steelhead in fisheries to specified population thresholds or circumstances for the protection of the listed species. The application of VSP critical and viable population thresholds will be dependent upon determinations by the Technical Recovery Team (TRT) for the listed ESUs. Currently, the Technical Recovery Team is in the process of identifying ESU population structure and abundance levels for the critical and viable thresholds.

The VSP criteria encompass not only abundance, but also population productivity trends, spatial distribution, and diversity. When developed, the critical threshold will generally represent a state where a population is at relatively low abundance or productivity. At the viable threshold, a population is functioning properly and at a self-sustaining abundance level. Derivation of these thresholds for abundance will be based upon the specific ESU and historic information on population distribution and abundance. In general, if population abundance is less than 500 to 5,000 per generation, there is an increased risk of extinction. If the salmonid population generation length is three to four years (the approximate generation length for steelhead and chum), the annual spawner abundance at this critical level would be in the range of 125-167 to 1,250-1,670 fish. At viable levels, abundance would range from 5,000 to 10,000 fish per generation, or (for fish with a four-year generation length) 1,250 to 2,500 spawners per year.

Because the critical and viable population thresholds have not been developed for the populations in the LCR ESUs, impacts from the proposed activities considered in this opinion will be analyzed based on impacts on other metrics of listed populations. Below are discussions of the life histories and status of the salmon and steelhead populations within the action area.

3.1 Chinook Salmon

Chinook salmon are the largest of the Pacific salmon. The species' North American distribution historically ranged from the Ventura River in California to Point Hope, Alaska. In northeastern Asia, the species range from Hokkaido, Japan to the Anadyr River in Russia (Healey 1991). Additionally, chinook salmon have been reported in the Mackenzie River area of northern Canada (McPhail and Lindsey 1970). Of the Pacific salmon, chinook salmon exhibit the most diverse and complex life-history strategies. Healey (1986) described 16 age categories for chinook salmon, seven total ages at maturity with three possible freshwater ages. Gilbert (1912) initially described two general freshwater life-history types: “stream-type” chinook salmon reside in fresh water for a year or more following emergence; “ocean-type” chinook salmon migrate to the ocean within their first year. Healey (1983, 1991) has promoted the use of broader definitions for “ocean-type” and “stream-type” to describe two distinct races of chinook salmon. This racial approach incorporates life history traits, geographic distribution, and genetic differentiation and provides a valuable frame of reference for comparisons of chinook salmon populations. The generalized life history of Pacific salmon includes phases of incubation, hatching, freshwater emergence, migration to the ocean, and subsequent initiation of maturation and return to fresh water for completion of maturation and spawning. Juvenile rearing in fresh water can be minimal or extended. Additionally, some male chinook salmon mature in fresh water, thereby foregoing emigration to the ocean. The timing and duration of each of these stages is related to varying degrees of genetic and environmental determinants and interactions thereof. Chinook salmon may spend one to six years in the ocean before returning to their natal streams to spawn.

Ocean distribution differs between ocean- and stream-type chinook (Healey 1983, 1991). Ocean-type chinook tend to migrate along the coast, and stream-type chinook migrate far from the coast in the central North Pacific. Chinook populations within the ESUs discussed here can be characterized by their time of freshwater entry as spring, summer, or fall runs. Spring chinook tend to enter freshwater and migrate far upriver, where they hold and become sexually mature before spawning in the late summer and early autumn. Fall chinook enter freshwater in a more advanced stage of sexual maturity, move rapidly to their spawning areas on the mainstem or lower tributaries of their natal rivers and spawn within a few days or weeks of freshwater entry (Fulton 1968, Healey 1991). Summer chinook are intermediate between spring and fall runs, spawning in large and medium-sized tributaries, and not showing the extensive delay in maturation exhibited by spring chinook (Fulton 1968).

3.1.1 LCR Chinook Salmon ESU

The LCR chinook salmon ESU is characterized by numerous short- and medium-length rivers that drain the coast ranges and the west slope of the Cascade Mountains. This ESU includes all native populations from the mouth of the Columbia River to the crest of the Cascade Range, excluding populations above Willamette Falls. The former location of Celilo Falls (drowned by The Dalles reservoir in 1960) is the eastern boundary for this ESU (Figure 1). The Cowlitz, Kalama, Lewis, Washougal, and Wind Rivers constitute the major systems in Washington; the lower Willamette, Clackamas, Hood and Sandy Rivers are the major systems in Oregon. The ESU does not include spring chinook salmon populations in the Clackamas River or the introduced Carson spring chinook salmon stock. Tule fall chinook salmon in the Wind and White Salmon Rivers are included in this ESU, but not the introduced upriver bright fall chinook salmon populations in the Wind and White Salmon Rivers and those spawning naturally below Bonneville Dam (Myers *et al.* 1998). Of the fourteen hatchery stocks included in the ESU, one was considered essential for recovery (Cowlitz River spring chinook) but was not listed (64 FR 14308). WDF *et al.* (1993) identified 20 stocks within the ESU, but surveyed only Washington stocks which did not include the Clackamas tule, Sandy spring or Sandy late fall bright spawning aggregations in Oregon.

There are three different runs of chinook salmon in the LCR ESU: spring-run, late fall brights, and early fall tules. Spring-run chinook salmon in the lower Columbia River, have a stream-type juvenile life history and enter freshwater as adults in March and April, well in advance of spawning in August and September. Historically, fish migrations were synchronized with periods of high rainfall or snow melt to provide access to upper reaches of most tributaries where spring stocks would hold until spawning (Fulton 1968; Olsen *et al.* 1992; WDF *et al.* 1993). The tule and bright fall chinook exhibit an ocean-type live history and northerly ocean migration patterns, with bright fish tending to travel father north than the tule stocks. Tule fall chinook begin entering the Columbia River in August, rapidly moving into the lower Columbia River tributaries to begin spawning in September and October. Bright fall chinook enter the Columbia River over a longer period of time beginning in August and do not begin spawning until October with spawning observed into the following March in some locations. All lower Columbia River chinook mature from two to six years of age, primarily returning as three and four year old adults (Myers *et al.* 1998).

Estimated overall abundance of chinook salmon in this ESU is not cause for immediate concern. Long-term trends in fall run escapement are mixed, with most larger stocks positive, while the spring run trends are positive or stable. Short-term trends for both runs are more negative, some severely so (Myers *et al.* 1998). However, apart from the relatively large and apparently healthy fall-run population in the Lewis River, production in this ESU appears to be predominantly hatchery-driven with few identifiable native, naturally reproducing populations. About half of the populations comprising this ESU are very small, increasing the likelihood that risks due to genetic and demographic processes in small populations will be important.

Spring chinook were present historically in the Sandy, Clackamas[1], Cowlitz, Kalama, Hood and Lewis Rivers. Spawning and juvenile rearing areas have been eliminated or greatly reduced by dam construction on all these rivers. The native Lewis River run became extinct soon after completion of Merwin Dam in 1932. The natural Hood River spring chinook population was extirpated in the 1960's after a flood caused by the natural breaching of a glacial dam resulted in extensive habitat damage in the West Fork production areas. Currently non-listed hatchery spring chinook from the Deschutes River are being released into the Hood River as part of a reintroduction program. The remaining spring chinook stocks in the Lower Columbia River ESU are found in the Sandy, Lewis, Cowlitz, and Kalama Rivers (Figure 1). Numbers of naturally spawning spring-run chinook salmon are very low, and have historically had or continue to have substantial contributions of hatchery fish. Recent escapements above Marmot Dam on the Sandy River average 2,800 and have been increasing (ODFW 1998). Hatchery-origin spring chinook are no longer released above Marmot Dam; the proportion of first generation hatchery fish in the escapement is relatively low, on the order of 10-20% in recent years. Recent average escapement of naturally spawning spring chinook adults in the Cowlitz, Kalama, and Lewis Rivers are 237, 198, and 364, respectively (LeFleur 2000, 2001). The amount of natural production resulting from these escapements is unknown, but is presumably small since the remaining habitat in the lower rivers is not the preferred habitat for spring

[1] Clackamas River spring chinook are considered part of the listed Upper Willamette River chinook ESU.

chinook (ODFW 1998). Hatchery escapement goals have been consistently met in the Cowlitz and Lewis Rivers. In the past, when necessary, brood stock from the Lewis was used to meet production goals in the Kalama. Although the status of hatchery stocks are not always a concern or priority from an ESA perspective, in situations where the historic spawning habitat is no longer accessible, the status of the hatchery stocks is pertinent.

Fall chinook populations in the Lower Columbia River are self sustaining and escapements are generally stable (ODFW 1998). The tule component of the fall chinook populations spawn in the Coweeman, East Fork Lewis and Clackamas Rivers (Figure 1). Escapements for these populations have ranged from several hundred to 1,000 per year (WDFW 2003). Some natural spawning of tule fall chinook occurs in other areas but is thought to result primarily from hatchery-origin strays. Tule fall chinook are produced at the Elochoman, Cowlitz, Toutle, Kalama, Spring Creek and Washougal hatcheries in Washington and Big Creek hatchery in Oregon. The bright component of Lower Columbia River fall chinook spawn in the North Fork Lewis, East Fork Lewis and Sandy Rivers. Lower Columbia River bright stocks are among the few healthy natural chinook stocks in the Columbia River Basin. Escapement to the North Fork Lewis River has exceeded its escapement goal of 5,700 by a substantial margin every year since 1980, except 1999, with a recent five year average escapement of 8,400. Escapements of the two smaller populations of brights in the Sandy and East Fork Lewis River have been stable for the last 10-12 years and are largely unaffected by hatchery fish (NMFS 2001; ODFW 1998).

Freshwater habitat is in poor condition in many basins, with problems related to forestry practices, urbanization, and agriculture. Dam construction on the Cowlitz, Lewis, White Salmon, and Sandy Rivers has eliminated access to a substantial portion of the spring-run spawning habitat, with a lesser impact on fall-run habitat (Myers *et al.* 1998).

The large numbers of hatchery fish in this ESU make it difficult to determine the proportion of naturally produced fish. In spite of the heavy impact of hatcheries, genetic and life-history characteristics of populations in this ESU still differ from those in other ESUs. However, the potential loss of fitness and diversity resulting from the introgression of hatchery fish within the ESU is an important concern. In response to concerns about straying into tributaries of the Lower Columbia (Myers *et al.* 1998), the release locations for non-ESU Rogue River bright fall-run fish in Youngs Bay were changed and as a result, stray rates have declined markedly ®. Turner, NMFS, to S. Bishop, NMFS, pers. comm., February 19, 2002).

In 2002-2003, status reviews were conducted by the West Coast Biological Review Team (BRT) (WCSBRT 2003). The BRT, based on a synthesis of the updated information provided in their report plus the information contained in previous LCR status reviews, tentatively identified the number of historical and currently viable populations (Table A.2.5.5 of the report). The summary indicated that the ESU is substantially modified from historical population structure. Most tule fall chinook populations are potentially at risk of extinction and no populations of the spring run life-history type are currently considered self-sustaining. The Lewis River late fall bright population has the highest likelihood of being self-sustaining under current conditions. The BRT concluded that the ESU remains “likely to become endangered in the foreseeable future.”

3.2 Steelhead

Steelhead in North America are distributed from Northwestern Mexico to the Kuskokwim River in Alaska (Lichatowich 1999). Steelhead exhibit more complex life history traits than other Pacific salmonid species. Some forms of steelhead are anadromous; while others, called rainbow or redband trout, reside permanently in freshwater. Anadromous steelhead reside in freshwater for as long as seven years before moving to the ocean. Steelhead typically reside in marine waters for two to three years before returning to their natal stream to spawn at four or five years of age. Some Oregon and California populations include "half-pounders" that migrate from the ocean to freshwater and return to the ocean without spawning (Busby *et al.* 1996).

Steelhead trout can be divided into two basic run types based on the level of sexual maturity at the time of river entry and the duration of the spawning migration (Burgner *et al.* 1992). The stream-maturing type (inland), or summer steelhead, enters freshwater in a sexually immature condition and requires several months in freshwater to mature and spawn. The ocean-maturing type (coastal), or winter steelhead, enters freshwater with well-developed gonads and spawns shortly after river entry (Barnhart 1986). Variations in migration timing exist between populations. Both summer and winter steelhead occur in British Columbia, Washington and Oregon; Idaho has only summer steelhead; California is thought to have only winter steelhead (Busby *et al*. 1996). In the Pacific Northwest, summer steelhead enter freshwater between May and October, and winter steelhead enter freshwater between November and April.

Steelhead are iteroparous, or capable of spawning more than once before death. Steelhead spawn in cool, clear streams with suitable gravel size, depth, and current velocity. Intermittent streams may also be used for spawning (Barnhart 1986; Everest 1973). Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn and are vulnerable to disturbance and predation. Cover, in the form of overhanging vegetation, undercut banks, submerged vegetation, submerged objects such as logs and rocks, floating debris, deep water, turbulence, and turbidity (Geiger 1973) is required to reduce disturbance of and predation on spawning steelhead. Summer steelhead usually spawn further upstream than winter steelhead (Withler 1966; Behnke 1992). Juveniles typically rear in freshwater from 1 to 4 years before migrating to the ocean. Winter steelhead generally smolt after 2 years in freshwater (Busby *et al.* 1996). Steelhead typically reside in marine waters for 2 or 3 years before returning to their natal stream to spawn at 4 or 5 years of age.

Based on catch data, juvenile steelhead tend to migrate directly offshore during their first summer, rather than migrating nearer to the coast as do salmon. During fall and winter, juveniles move southward and eastward (Hartt and Dell 1986). Available fin-mark and coded-wire tag data suggests that winter steelhead tend to migrate farther offshore but not as far north into the Gulf of Alaska as summer steelhead (Burgner *et al.* 1992). Maturing Columbia River steelhead are found off the coast of Northern British Columbia and west into the North Pacific Ocean (Busby *et al.* 1996). At the time adults are entering freshwater, tagging data indicate that immature Columbia River steelhead are out in the mid-North Pacific Ocean.

3.2.1 LCR Steelhead ESU

The LCR steelhead ESU includes all naturally produced steelhead in tributaries to the Columbia River between the Cowlitz and Wind Rivers in Washington and the Willamette and Hood Rivers in Oregon, excluding steelhead in the upper Willamette River above Willamette Falls (Upper Willamette ESU) (Busby *et al.* 1996)(Figure 2). Steelhead in this ESU belong to the coastal genetic group (Schreck *et al.* 1986; Reisenbichler *et al.* 1992; Chapman *et al.* 1994) and include both winter steelhead (Cowlitz, Toutle, Coweeman, Kalama, Washougal, Sandy, Hood, Clackamas and Wind Rivers) and summer steelhead (Kalama, Lewis, Hood, Wind, and Washougal Rivers). WDF *et al.* (1993) identified 19 stocks considered to be predominantly of natural production. Among hatchery stocks, late-run Cowlitz River Trout Hatchery winter steelhead and the late-run Clackamas River hatchery winter steelhead are part of the ESU, but are not considered essential for recovery. Hatchery programs using endemic natural stocks of winter steelhead have been developed in the Sandy, Kalama, and Hood River basins since the listing.

Life history attributes for steelhead within this ESU appear to be similar to those of other west coast steelhead. Most LCR steelhead rear two years in freshwater and spend one or two years in the ocean prior to re-entering fresh water, where they may remain up to a year prior to spawning (Howell *et al.* 1985; BPA 1992). Summer-run stocks generally enter freshwater from May through October while winter stocks generally enter freshwater from November to May (Busby *et al* 1996). Peak entry generally occurs in July (B. Leland to S. Bishop, pers. comm., July 1999).

No estimates of historical abundance (pre-1960s) specific to this ESU are available. A conservative estimate of current abundance puts the average run size at greater than 16,000. Abundance trends are mixed and possibly affected by short-term climate conditions. At the time of NMFS' status review in 1996, the majority of stocks for which data are available within this ESU were declining, although some had increased strongly. The strongest upward trends were those of either non-native stocks (lower Willamette River and Clackamas River summer steelhead) or stocks recovering from major habitat disruption and still at low abundance (mainstem and North Fork Toutle River) (Busby *et al.* 1996). Since 1996 when the status review was completed, listed Lower Columbia River steelhead populations have generally increased, with some populations rebounding more quickly than others.

The magnitude of hatchery production, habitat blockages from dams, and habitat degradation from logging and urbanization are areas of concern. The widespread production of hatchery steelhead within this ESU (hatchery contribution in some areas over 50%) creates specific concerns for summer steelhead and Oregon winter steelhead stocks, where there appears to be substantial overlap in spawning between hatchery and natural fish (Busby *et al.* 1996). Most of the hatchery stocks originate from stocks within the ESU, but many are not native to local river basins. Because of their limited distribution in upper tributaries and the urbanization surrounding the lower tributaries (e.g., the lower Willamette, Clackamas, and Sandy rivers run through Portland, Oregon, or its suburbs), summer steelhead appear to be more at risk from habitat degradation than winter steelhead.

Recent adult return data for this ESU are summarized in NMFS' biological opinion on the operation of the Federal Columbia River Power System (FCRPS) (NMFS 2000a). For the larger runs, (Cowlitz, Kalama, and Sandy Rivers), current counts have been in the range of 1,000 to 2,000 fish. Historical counts for these runs, however, were more than 20,000 fish. In general, all the runs in the ESU have declined over the past 20 years, exhibiting sharp declines in the last five years. Escapement estimates for the steelhead fishery in the LCR ESU are based on in-river and estuary sport-fishing reports. There is also a limited ocean fishery on this ESU. Harvest rates range from 20% to 50% of the total run, but harvest rates on naturally produced fish have dropped to 0% to 4% in recent years (punch card data from Washington Department of Fish and Wildlife through 1994).

The 1996 NMFS steelhead status review (Busby *et al.* 1996) concluded that this ESU is not presently in danger of extinction but is likely to become so in the foreseeable future. The majority of stocks for which we have data within this ESU have been declining recently, but some have shown strong increases. However, the strongest upward trends are those of either non-native stocks (Lower Willamette River and Clackamas River summer steelhead) or stocks that are recovering from major habitat disruption and are still at low abundance (mainstem and North Fork Toutle River). The data series for most stocks are quite short, so the preponderance of downward trends may reflect a general coastwide decline in steelhead abundances in recent years.

The major area of uncertainty in the status review is the degree of interaction between hatchery and natural stocks within the ESU. There is widespread production of hatchery steelhead within this ESU and several stocks for which there are hatchery composition estimates that average more than 50% hatchery fish in natural escapement. Concerns about hatchery influence are especially strong for summer steelhead and Oregon winter steelhead stocks, where there appears to be substantial overlap in spawning between hatchery and natural fish. WDFW's conclusion that there is little overlap in spawning between natural and hatchery stocks of winter steelhead throughout the ESU is generally supported by available evidence. However, with the exception of detailed studies of the Kalama River winter stock, it is based largely on models with assumed run times rather than empirical data. There is apparently strong overlap in spawning between hatchery and natural summer steelhead in tributaries on the Washington side of the lower Columbia River. We have no information regarding potential spawning separation between hatchery and natural fish in Oregon tributaries of the lower Columbia River (Busby *et al.* 1996).

In its 2002-2003 status reviews, the WCSBRT indicated some of the uncertainty about the ESU, with the BRT unable to conclusively identify a single population that is naturally self-sustaining (WCSBRT 2003, especially see Table B.2.4.5 of the report). Over the period of the available time series, most of the populations are in decline and are at relatively low abundance (no population has a recent mean greater than 750 spawners). In addition, many of the populations continue to have a substantial fraction of hatchery origin spawners and may not be naturally self-sustaining. The BRT concluded that the ESU remains "likely to become endangered in the foreseeable future" (WCSBRT 2003).

3.3 Chum salmon

Chum salmon are semelparous, spawn primarily in freshwater, and apparently exhibit obligatory anadromy, as there are no recorded landlocked or naturalized freshwater populations (Randall *et al.* 1987). The species is known for the enormous canine-like fangs and striking body color (a calico pattern, with the anterior two thirds of the flank marked by a bold, jagged, reddish line and the posterior third by a jagged black line) of spawning males. Females are less flamboyantly colored and lack the extreme dentition of the males.

The species has the widest natural geographic and spawning distribution of any Pacific salmonid, primarily because its range extends further along the shores of the Arctic Ocean than other salmonids. Chum salmon have been documented to spawn from Korea and the Japanese island of Honshu, east, around the rim of the North Pacific Ocean, to Monterey Bay in California. Presently, major spawning populations are found only as far south as Tillamook Bay on the Northern Oregon coast. The species' range in the Arctic Ocean extends from the Laptev Sea in Russia to the Mackenzie River in Canada. Chum salmon may historically have been the most abundant of all salmonids: Neave (1961) estimated that prior to the 1940s, chum salmon contributed almost 50% of the total biomass of all salmonids in the Pacific Ocean. Chum salmon also grow to be among the largest of Pacific salmon, second only to chinook salmon in adult size, with individual chum salmon reported up to 43 in. (108.9cm) in length and 45 pounds (20.8kg) in weight (Pacific Fisherman 1928). Average size for the species is around 8 to 15 pounds (3.6 to 6.8kg) (Salo 1991).

Chum salmon spend more of their life history in marine waters than other Pacific salmonids. Chum spend two to five years in the northeast Pacific Ocean feeding areas prior to migrating southward during the summer months as maturing adults along the coasts of Alaska and British Columbia in returning to their natal streams (WDFW/PNPTT 2000) (Figure 3). Most chum mature as four year old adults (Johnson *et al.* 1997). Chum salmon usually spawn in the lower reaches of rivers, with redds usually dug in the mainstem or in side channels of rivers from just above tidal influence to nearly 60 miles (100km) from the sea. Chum salmon, like pink salmon, usually spawn in coastal areas, and juveniles out migrate to seawater almost immediately after emerging from the gravel that covers their redds (Salo 1991). This ocean-type migratory behavior contrasts with the stream-type behavior of some other species in the genus *Oncorhynchus* (e.g., coastal cutthroat trout, steelhead, coho salmon, and most types of chinook and sockeye salmon), which usually migrate to sea at a larger size, after months or years of freshwater rearing. This means survival and growth in juvenile chum salmon depends less on freshwater conditions than on favorable estuarine conditions. Another behavioral difference between chum salmon and species that rear extensively in freshwater is that chum salmon form schools, presumably to reduce predation (Pitcher 1986), especially if their movements are synchronized to swamp predators (Miller and Brannon 1982).

3.3.1 Columbia River Chum Salmon ESU

This ESU includes all naturally produced chum salmon populations that enter the Columbia River (Figure 3). Historically, chum salmon were abundant in the lower reaches of the Columbia

River and may have spawned as far upstream as the Walla Walla River (Johnson *et al.* 1997). However, reductions in available habitat currently limit chum salmon in the Columbia River to tributaries below Bonneville Dam. Most of the historic runs disappeared by the 1950s (Rich 1942; Marr 1943; Fulton 1970). Historically, the CR chum salmon ESU supported a large commercial fishery landing more than 500,000 fish per year. Commercial catches declined beginning in the mid-1950s. There are now no recreational or directed commercial fisheries for chum salmon in the Columbia River, although chum salmon are taken incidentally in the gill-net fisheries for coho and fall chinook salmon and in recreational fisheries targeting other species.

Because of the well-known aversion of chum salmon to surmounting in-river obstacles to migration, the effects of the mainstem Columbia River hydropower system have probably been more severe for chum salmon than for other salmon species. Bonneville Dam presumably continues to impede the recovery of upriver populations. Substantial habitat loss in the Columbia River estuary and associated areas presumably was an important factor in the decline and also represents a continuing risk for this ESU.

The Upper Willamette/Lower Columbia River Technical Recovery Team (TRT) has identified 16 historical populations in the ESU. Currently, the WDFW regularly monitors two primary population centers where natural spawning populations still exist. The two population centers are in the Grays River and the Lower Gorge (below Bonneville Dam). In 1999, WDFW located another Columbia River mainstem spawning area for chum salmon located near the I-205 bridge. Hatchery fish have had little influence on the naturally produced component of the CR chum salmon ESU. In the Grays River the majority of the chum spawning occurs in less than 1 mile of the river. Prior to its destruction in a 1998 flood, an artificial spawning channel created by WDFW in 1986, was the location of approximately 50% of the spawning in the Grays River chum population. Data from the BRT preliminary report (WCSBRT 2003) indicates both long term and short term negative trends in productivity and in growth for the population. Abundance estimates for 2002 suggest a substantial increase in the abundance over what was observed over the last 50 years. Survey crews have handled over 7,000 chum salmon carcasses in the Grays River in 2002, but the total population size is in the neighborhood of 10,000 adults. However, a new chum hatchery program in the Grays River started in 1999 confounds the abundance estimates. In 1999, 120,000 hatchery chum were released into the Grays River and 60,000 hatchery chum salmon were released into the Chinook River. These fish returned as 3-year-olds in 2002 and are included in the 10,000 adult estimate. The hatchery fish were otolith marked, so it will be possible to determine the fraction of hatchery origin spawners once the otoliths are read, but that information is not available at this time. The Chinook River is a sub-population of the Grays River population that had essentially no chum in recent years, prior to 2002 return of hatchery fish. In 2002, a preliminary estimate of 600 chum returned to the Chinook River, suggesting a 1% return of 3 year olds from the hatchery fish. Extrapolating this return rate to the Grays River, 1,200 of the estimated 10,000 returns would be of hatchery origin, suggesting that the large increase in the Grays River is not simply the result of the hatchery program (WCSBRT 2003).

The Lower Gorge population consists of a number of sub-populations immediately below Bonneville Dam. The sub-populations include Hardy Creek, Hamilton Creek, Ives Island, and the Multnomah area. Both the Ives Island and Multnomah area sub-populations spawn in the Columbia River mainstem. Long term abundance estimates for the Hardy Creek and Hamilton Creek sub-populations are in the WDFW FMEP (WDFW 2003); Hamilton Creek estimates also include adults returning to the artificial spawning channel in Hamilton Creek. These abundance estimates may not be representative of the Lower Gorge population because it does not include mainstem spawning areas. Chum salmon may alternate between the tributaries and the mainstem, depending on flow conditions, causing counts in only a subset of the population to be poor indicators of the total population abundance in a given year. Based on these data, the population has shown a downward trend since the 1950s and has been at relatively low abundance up until 2000. However, preliminary data indicated that the 2002 abundance has shown a substantial increase estimated at greater than 2,000 chum in Hamilton and Hardy Creeks, plus another 8,000 or more in the mainstem (WCSBRT 2003).

The WDFW has started a chum salmon conservation program for the Lower Gorge group, collecting adults in the Ives Island area for broodstock. The broodstock is spawned and the juveniles reared at the Washougal Fish Hatchery. This hatchery program will supplement the Ives Island population and provide juveniles for release into Duncan Creek. Access to Duncan Creek for chum salmon was reestablished in 2001, when a dam at the outlet of a manmade lake was modified to allow passage. In addition, chum salmon spawning channels were developed in areas of historic upwelling adjacent to Duncan Creek. The improved access and the new spawning channels were immediately successful such that within 3 days after completion of work on the channels they were being used by spawning chum salmon. The hatchery program production goal is to release 100,000 chum salmon after a short rearing period (fish will be 500 fish to the pound).

Another sub-population of the Lower Gorge group

A group of chum were recently observed (since 1998-1999) to be spawning in the mainstem Columbia River on the Washington side, just upstream of the I-205 bridge (the "I-205 population"). These spawners are considered to be part of the W/LC TRT's Washougal population of chum salmon, as this is the closest tributary mouth (WCSBRT 2003). It is not clear if this is a recently established population or only recently discovered by WDFW. In 2000, WDFW estimated 354 spawners at this location. As with the other Columbia River chum salmon spawning populations, preliminary data indicated a dramatic increase in 2002. Preliminary estimates put the abundance of this population in the range of several thousand spawners (WCSBRT 2003).

Oregon populations

Chum spawn on the Oregon side of the lower gorge population (Multnomah area), but appear to be essentially absent from other areas in the Oregon portion of this ESU. In 2000, ODFW conducted surveys with a purpose similar to the WDFW 2000 surveys (i.e., to determine the abundance and distribution of chum in the Columbia). Out of 30 sites surveyed, only one chum was observed. With the exception of the Lower Gorge population, Columbia chum are considered extirpated, or nearly so, in Oregon.

As a result of its 2002-2003 status reviews, the BRT tentatively identified the number of historical and currently viable populations (Table E.2.2.5 (WCSBRT 2003)). At least 88% of the historical populations appear to have been extirpated, or nearly so. The extant populations have been at low abundance for the last 50 years in the range where stochastic processes could lead to extinction. Encouragingly, there has been a substantial increase in the abundance of these two populations and the new (or newly discovered) I-205 population. However, it is not known if this increase will continue, and the abundance is still substantially below the historical levels. The BRT concluded that the ESU remains “likely to become endangered in the foreseeable future” (WCSBRT 2003).

4. Environmental Baseline

The environmental baseline is an analysis of the effects of past and present human and natural factors leading to the current status of the species or its habitat and ecosystem within the action area. The action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 402.02). The environmental baseline for this Opinion includes the effects of several activities that affect the survival and recovery of threatened and endangered species in the action area. The activities having the greatest impact on the environmental baseline generally fall into four categories: hydro-power system impacts on juvenile outmigration and adult return migration; habitat degradation effects on water quality and availability of adequate incubation and rearing locations; artificial propagation and harvest impacts. The fish are also affected by fluctuations in natural conditions. The following discussion reviews recent developments in each of the sectors, and outlines their anticipated impacts on natural conditions and the future performance of the listed ESUs.

4.1 Hydro-Power System

Columbia River basin anadromous salmonids, especially those above Bonneville Dam, have been dramatically affected by the development and operation of the Federal Columbia River Power System (FCRPS). Storage dams have eliminated spawning and rearing habitat and have altered the natural hydrograph of the Snake and Columbia rivers, decreasing spring and summer flows and increasing fall and winter flows. Power operations cause fluctuation inflow levels and river elevations, affecting fish movement through reservoirs and riparian ecology and stranding fish in shallow areas. The eight dams in the migration corridor of the Snake and Columbia rivers alter smolt and adult migrations. Smolts experience a high level of mortality passing through the dams. The dams also have converted the once-swift river into a series of slow-moving reservoirs, slowing the smolts’ journey to the ocean and creating habitat for predators. Water velocities throughout the migration corridor are now far more dependent on volume runoff than before development of the mainstem reservoirs. These factors not only affect populations above Bonneville Dam but also those populations below the Federal Dams when they use the mainstem Columbia River as a migration corridor.

There have been numerous changes in the operation and configuration of the FCRPS as a result of ESA consultations between the hydrosystem Action Agencies (BPA, COE, BOR) and the Services (NMFS and USFWS). These have resulted in survival improvements for listed fish migrating through the Snake and Columbia rivers. Increased spill at all of the FCRPS dams allows smolts to avoid both turbine intakes and bypass systems. Increased flow in the mainstem Snake and Columbia rivers provides better inriver conditions for smolts. The transportation of smolts from the Snake River has also been improved by the addition of new barges and modification of existing barges.

The effects of FCRPS hydropower projects on 12 listed Columbia River Basin salmonid species have been evaluated by NMFS in a recent biological opinion (NMFS 2000a). NMFS concluded that the proposed operation and configuration of the FCRPS and the BOR projects are likely to jeopardize the continued existence of the 8 listed ESUs and to adversely modify their designated critical habitat (opinion was crafted before the rescission of critical habitat designation). The actions were determined as not likely to jeopardize the Lower Columbia River chinook and steelhead, and Upper Willamette River spring-run chinook and steelhead ESUs.

There are hydro-power system impacts that also affect LCR ESUs, but not to the degree that the FCRPS affects ESUs originating above Bonneville Dam. One impact is the loss of habitat from irrigation and hydro-power dams that has substantially reduced the available spawning and rearing habitat for the listed species. For example, current available habitat for both LCR chinook and LCR steelhead is only 63% of the potential habitat that was historically available (WCSBRT 2003). For many historic spring chinook populations habitat has been reduced to zero (Cispus River, Tilton River, Big White Salmon River and Upper Cowlitz River) or has been severely reduced as in the Lewis River. For chum salmon the remaining habitat is estimated to be 85% of what was historically available, but this estimate does not include habitat that was lost above Bonneville Dam.

4.2 Habitat

Water quality in streams throughout the LCR basin has been degraded by human activities such as dams and diversion structures, water withdrawals, farming and grazing, road construction, timber harvest, mining, and urbanization. In the Columbia River Basin, over 2,500 streams and river segments and lakes do not meet Federally approved, state and Tribal water quality standards and are now listed as water quality limited under Section 303(d) of the Clean Water Act (CWA). Tributary water quality problems contribute to poor water quality where sediment and contaminants from the tributaries settle in mainstem reaches and the estuary.

Highway culverts that are not designed for fish passage can block upstream migration. Migrating fish are also diverted into unscreened or inadequately screened water conveyances or turbines, resulting in unnecessary mortality. Whereas many fish-passage improvements have been made in recent years, manmade structures continue to block migrations or kill fish throughout the basin.

Land ownership has played a part in habitat and land use changes. While there is substantial habitat degradation across all ownerships, in general, habitat in many Federally managed headwater stream sections is in better condition than in the largely non-Federal lower portions of tributaries (Doppelt *et al.* 1993; Frissell 1993; Henjum *et al.* 1994; Quigley and Arbelbide 1997). In the past, valley bottoms were among the most productive fish habitats in the basin (Stanford and Ward 1992; Spence *et al.* 1996; ISG 1996). Today, agricultural and urban land development and water withdrawals have critically altered the habitat for fish and wildlife. Streams in these areas typically have high water temperatures, sedimentation problems, low flows, simplified stream channels, and reduced riparian vegetation.

The Columbia River estuary has also been changed by human activities. Historically, the downstream half of the estuary was a dynamic environment with multiple channels, extensive wetlands, sandbars and shallow areas. The mouth of the Columbia River was about 4 miles wide. Winter and spring floods, low flows in late summer, large woody debris floating downstream and a shallow bar at the mouth of the Columbia River kept the environment dynamic. Today, navigation channels have been dredged, deepened and maintained, jetties and pile dike fields have been constructed to stabilize and concentrate flow in navigation channels, marsh and riparian habitats have been filled and diked, and causeways have been constructed across waterways. These actions have decreased the width of the mouth of the Columbia River to 2 miles and increased the depth of the Columbia River channel at the bar from less than 20 to more than 55 feet. Sand deposition at river mouths has extended the Oregon coastline approximately 4 miles seaward and the Washington coastline approximately 2 miles seaward (Thomas 1981).

More than 50% of the original marshes and spruce swamps in the estuary have been converted to industrial, transportation, recreation, agricultural, or urban uses. More than 3,000 acres of intertidal marsh and spruce swamps have been converted to other uses since 1948 (LCREP 1999). Many wetlands along the shore in the upper reaches of the estuary have been converted to industrial and agricultural lands after levees and dikes were constructed. Furthermore, water storage and release patterns from reservoirs upstream of the estuary have changed the seasonal pattern and volume of discharge. The peaks of spring-summer floods have been reduced, and the amount of water discharged during winter has increased.

Studies begun in 1997 by the Oregon Cooperative Fish and Wildlife Research Unit, USGS, and CRITFC have shown that fish-eating birds that nest on islands in the Columbia River estuary (Caspian terns, double-crested cormorants, and glaucous-winged gulls) are substantial avian predators of juvenile salmonids. Researchers estimated that the tern population on Rice Island (16,000 birds in 1997) consumed 6 to 25 million outmigrating smolts during 1997 (Roby *et al.* 1998) and 7 to 15 million outmigrating smolts during 1998 (Collis *et al.* 1999). The observed levels of predation prompted the regional fish and wildlife managers to investigate the feasibility of management actions to reduce the impacts. Early management actions appear to have reduced predation rates; researchers estimate that terns consumed 7.3 million smolts during 1999 (Columbia Bird Research 2000). It was estimated that in 2000 and 2001 the East Sand Island population consumed 5.9 million and 6.5 million smolts, respectively (Columbia Bird Research 2003).

The Basinwide Recovery Strategy (NMFS 2000b) outlines a broad range of habitat programs. Because some of the anadromous fish spawning habitat is in Federal ownership, Federal land management programs are of primary importance. Current management on Federal land is governed by an ecosystem-based aquatic habitat and riparian-area management strategy known as PACFISH and associated biological opinions. This interim strategy covers the majority of the basin accessible to anadromous fish and includes specific prescriptions designed to halt habitat degradation. The Basinwide Recovery Strategy also outlines a large number of non-Federal habitat programs. Because non-Federal habitat is managed predominantly for private rather than public purposes, however, expectations for non-Federal habitat are harder to assess. Degradation of habitat for listed fish from activities on non-Federal lands is likely to continue to some degree over the next 10 years, although at a reduced rate due to state, Tribal, and local recovery plans.

4.3 Artificial Propagation

The current hatchery system in the Columbia River Basin includes over 70 hatchery programs and associated satellite facilities, some of which were initiated more than 110 years ago, and well before the salmon and steelhead were listed pursuant to the ESA (NMFS 1999a). Hatcheries in the Pacific Northwest have been used to mitigate for declines in salmon and steelhead abundance. Today, most salmon populations in this region are primarily hatchery fish. In 1987, for example, 95% of the coho, 70% of the spring chinook, 80% of the summer chinook, 50% of the fall chinook, and 70% of the steelhead returning to the Columbia Basin originated in hatcheries (CBFWA 1990).

The history, development, and management of anadromous fish artificial propagation facilities in the Columbia River Basin has been summarized by the Columbia Basin Fish and Wildlife Authority and USFWS (CBFWA 1990). A report by Brannon *et al.* (1999) updates the CBFWA report and identifies recent changes and reforms to hatchery operations and hatchery management and goes on to propose further changes. Hatchery programs funded to mitigate for declines in fish runs due to habitat destruction from hydropower construction, human development, resource extraction and overfishing have primarily been programed to produce fish for harvest. There is currently a shift occurring in hatchery management from not just augmenting harvest but to restoring, maintaining and conserving natural populations of anadromous salmonids as well (RASP 1992; NPPC 1994; Fast and Craig 1997). Within the last decade, hatchery programs have responded to ESA listings and the continuing declines in natural populations by shifting to conservation programs (see Flagg and Nash 1999). The goals of conservation programs are to restore and maintain natural populations. The change to conservation type hatchery programs has followed a general call for hatchery reform within the Pacific Northwest. The changes proposed are to ensure that existing natural salmonid populations are preserved, and that hatchery-induced genetic and ecological effects on natural populations are minimized while still achieving program goals.

Hatchery programs producing non-listed salmonid species are being used to benefit the fisheries that are proposed in the FMEPs under review in this opinion. Many of the artificial propagation programs are designed to provide surplus fish for harvest in commercial, tribal, and recreational fisheries. These non-listed fish production programs are also used to meet international harvest objectives set forth under the Pacific Salmon Treaty agreement, and to mitigate for natural salmonid production losses due to habitat blockage and degradation.

In general, the potential effects of artificial propagation on naturally produced populations include effects on the genetic and ecological health of natural populations, effects of fisheries management and the potential to mask the status of naturally producing stocks which effects public policy and decision making. NMFS' status reviews of the listed ESUs (Busby *et al.* 1996; Myers *et al.* 1998; Johnson *et al.* 1997; Weitkamp *et al.* 1995) and the recent BRT report (WSCBRT 2003) have identified hatchery effects as potential factors for the decline in these ESUs. The intent of hatchery reform is to strive to reduce negative effects of artificial propagation on natural populations while retaining its proven production and potential conservation benefits. For example, hatchery programs are in the process of phasing out use of improper broodstocks, such as out-of-basin or out-of-ESU stocks, replacing them with fish derived from, or more compatible with, locally adapted populations. The basic thrust of many of these reforms has been to produce fish that pose less risk to natural populations, either by minimizing interactions with natural populations or by making hatchery fish more compatible with them. Hatchery reform is needed not only to address artificial propagation's affects on listed fish but also to improve the overall success of artificial propagation programs.

Some reforms may require substantial and costly changes in existing programs and facilities. Because there is a range of scientific and policy opinions regarding the purpose and appropriate application of artificial propagation in specific circumstances, a number of strategies, coupled with an adaptive management approach, are warranted. These strategies are supported by the Action Agencies and their operators and in specific cases were prescribed to the Action Agencies of the FCRPS opinion (NMFS 2000a). The rate of implementation of hatchery program reforms are dependant on a number of factors. These factors include the availability of immediate funds, available broodstock, or the reform requires major hatchery facilities modifications. Some reforms can be implemented quickly including changing the number of hatchery fish released, altering the location of release to minimize ecological impacts on listed populations and preventing the transfer of inappropriate stocks to minimize genetic effects.

Scientific knowledge regarding the benefits and risks of artificial propagation is incomplete, but improving. Artificial propagation measures have proven effective in many cases at alleviating near-term extinction risks, yet the potential long-term benefits of artificial propagation as a recovery tool are unclear. Scientific uncertainty remains about whether and to what extent hatcheries, as they are currently operated, pose a continuing risk to natural populations. The hatchery operators conduct monitoring and evaluation activities to address these issues and to evaluate the success of artificial propagation programs and the reforms.

4.4 Harvest

Salmon and steelhead have been harvested in the Columbia basin as long as there have been people here. For thousands of years, native Americans have fished on salmon and other species in the mainstem and tributaries of the Columbia River for ceremonial and subsistence use and for barter. Salmon were possibly the most important single component of the native American diet, and were eaten fresh, smoked, or dried (Craig and Hacker 1940; Drucker 1965). A wide variety of gears and methods were used, including hoop and dip nets at cascades such as Celilo and Willamette Falls, to spears, weirs, and traps (usually in smaller streams and headwater areas) NRC 1996; Drucker 1965).

Commercial fishing developed rapidly with the arrival of European settlers and the advent of canning technologies in the late 1800s. Development of non-Indian fisheries began in about 1830; by 1861, commercial fishing was an important economic activity. The early commercial fishery used gill nets, seines hauled from shore, traps, and fish wheels. Later, purse seines and troll (using hook and line) fisheries were developed. Recreational (sport) fishing began in the late 1800s, occurring primarily in tributary locations (ODFW and WDFW 1998).

Initially, the non-Indian fisheries targeted spring and summer chinook salmon and these runs dominated the commercial harvest during the 1800s. Eventually the combined ocean and freshwater harvest rates for Columbia River spring/summer chinook exceeded 80% and sometimes 90% of the run, contributing to the species' decline (Ricker 1959). From 1938 to 1955, the average harvest rate dropped to about 60% of the total spring chinook salmon run and appeared to have a minimal effect on subsequent returns (NMFS 1991a). Until the spring of 2000, when a relatively large run of hatchery spring chinook returned and provided for a small commercial Tribal fishery, the last commercial season for spring chinook had occurred in 1977. Present Columbia River harvest rates are very low compared to those from the late 1930s through the 1960s (NMFS 1991a).

Following the sharp declines in spring and summer chinook in the late 1800s, fall chinook salmon became a more important component of the catch (NMFS 1991b). Fall chinook have provided the greatest contribution to Columbia River salmon catches in most years since 1890. Through the first part of this century, the commercial catch was usually canned for marketing. The peak year of commercial sales was 1911, when 49.5 million pounds of fall chinook were landed. Columbia River chinook salmon catches were generally stable from the beginning of commercial exploitation until the late 1940s, when landings declined by about two-thirds to a level that remained stable from the 1950s through the mid-1980s (ODFW and WDFW 1998). Since 1938, total salmonid landings (all species) have ranged from a high of about 2,112,500 fish in 1941 to a low of about 68,000 fish in 1995 (Figure A.1 in ODFW and WDFW 1998).

Whereas freshwater fisheries in the basin were declining during the first half of this century, ocean fisheries were growing, particularly after World War II. This trend occurred up and down the West Coast, as fisheries with new gear types leap-frogged over the others to gain first access to the migrating salmon runs. Large mixed-stock fisheries in the ocean gradually supplanted the freshwater fisheries, which were increasingly restricted or eliminated to protect spawning escapements. By 1949, the only freshwater commercial gear types remaining were gill net, dip and hoop nets (ODFW and WDFW 1998). This “leap-frogging” by various fisheries and gear types resulted in conflicts about harvest allocation and the displacement of one fishery by another. Ocean trolling peaked in the 1950s; ocean recreational fishing peaked in the 1970s. The ocean harvest has declined since the early 1980s as a result of declining fish populations and increased harvest restrictions (ODFW and WDFW 1998).

The construction of The Dalles Dam in 1957 had a major adverse effect on tribal fisheries. The Dalles Reservoir flooded Celilo Falls and inundated the site of a major Indian fishery that had existed for millennia. Commercial Indian landings at Celilo Falls from 1938 through 1956 ranged from 0.8 to 3.5 million pounds annually, based primarily on dip netting (ODFW and WDFW 1998). With the elimination of Celilo Falls, salmon harvest in the area declined dramatically. In 1957, in a joint action, the states of Oregon and Washington closed the Tribal fishery above Bonneville Dam to commercial harvesters. Treaty Indian fisheries that continued during 1957 through 1968 were conducted under tribal ordinances. In 1968, with the Supreme Court opinion on the appeal of the *Puyallup v. Washington* case, the states re-opened the area to commercial fishing by treaty Indians (ODFW and WDFW 1998). For the next 6 years, until 1974, only a limited tribal harvest occurred above Bonneville Dam. By then, the tribal fishery had developed an alternative method of setting gillnets which was suitable for catching salmon in the reservoirs (ODFW and WDFW 1998).

The capacity of salmonids to produce substantially more adults than are needed for spawning offers the potential for sustainable harvest of naturally produced (versus hatchery-produced) fish. This potential can be realized only if two basic management requirements are met: (1) enough adults return to spawn and perpetuate the run and (2) the productive capacity of the habitat is maintained. Catches may fluctuate in response to such variables as ocean productivity cycles, periods of drought, and natural disturbance events. However, as long as the two management requirements are met, fishing can be sustained indefinitely. Unfortunately, both prerequisites for sustainable harvest have been routinely violated in the past. The lack of coordinated management across jurisdictions, combined with competitive economic pressures to increase catches or to sustain them in periods of lower production, resulted in harvests that were too high and escapements that were too low. At the same time, habitat has been increasingly degraded, reducing the capacity of the salmon stocks to produce numbers in excess of their spawning escapement requirements.

For years, the response to declining catches was the construction of hatcheries to produce more fish. Because hatcheries require fewer adults to sustain their production, harvest rates in the fisheries were allowed to remain high, or even increase, further exacerbating the effects of overfishing on the natural (non-hatchery) portions of the runs mixed in the same fisheries. More recently, harvest managers have instituted reforms including weak stock, abundance-based, harvest rate and escapement goal management as well as selective fisheries.

4.5 Natural Conditions

Changes in the abundance of salmonid populations are substantially affected by changes in the freshwater and marine environments. For example, large scale climatic regimes, such as El Niño, affect changes in ocean productivity. Much of the Pacific coast was subject to a series of very dry years during the first part of the 1990s. In more recent years, severe flooding has adversely affected some stocks. For example, the low return of Lewis River bright fall chinook salmon in 1999 is attributed to flood events during 1995 and 1996.

Salmon and steelhead are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation may also contribute to natural mortality, although the levels of predation are largely unknown. In general, salmonids are prey for pelagic fishes, birds, and marine mammals, including harbor seals, sea lions, and killer whales. There have been recent concerns that rebounding seal and sea lion populations, following their protection under the Marine Mammal Protection Act of 1972, has resulted in substantial mortality for salmonids. In recent years, for example, sea lions have learned to target UWR spring chinook salmon in the fish ladder at Willamette Falls and at Bonneville Dam.

A key factor substantially affecting many west coast stocks has been the general pattern of a 30-year decline in ocean productivity. The mechanism whereby stocks are affected is not well understood. The pattern of response to these changing ocean conditions has differed among stocks, presumably due to differences in their ocean timing and distribution. It is presumed that survival is driven largely by events occurring between ocean entry and recruitment to a sub-adult life stage. One indicator of early ocean survival can be computed as a ratio of coded-wire tag (CWT) recoveries of subadults relative to the number of CWTs released from that brood year. Time series of survival rate information for Upper Willamette River spring chinook, Lewis River fall chinook, and Skagit fall chinook salmon show highly variable or declining trends in early ocean survival, with very low survival rates in recent years (NMFS 1999b).

Recent evidence suggests that marine survival of salmonids fluctuates in response to 20- to 30-year cycles of climatic conditions and ocean productivity (Beamish and Bouillon 1993; Beamish *et al.* 1999; Cramer *et al.* 1999; Hare *et al.* 1999). This phenomenon has been referred to as the Pacific Decadal Oscillation (PDO) (Mantua *et al.* 1997). Ocean conditions that affect the productivity of Northwest salmonid populations appear to have been in a low phase of the cycle for some time and to have been an important contributor to the decline of many stocks. The survival and recovery of these species will depend on their ability to persist through periods of low natural survival.

This opinion evaluates the effects of the proposed fisheries actions in the context of the species' current status. The relative health of the listed salmon and steelhead is critical to determining whether or not the proposed fisheries actions are likely to jeopardize the species. With this function of the environmental baseline in mind, NMFS does not attempt to quantitatively distinguish effects attributable to past operation of tributary fisheries and other factors from the likely future effects. What follows is a summary of the listed ESUs prospects using their current status as the population component of the environmental baseline.

5. ANALYSIS OF EFFECTS

5.1 Effects of Proposed Actions on Species and on Critical Habitat

In its biological opinions, NMFS analyzes the effects of the action as defined in 50 CFR 402.02. NMFS considers the estimated level of injury or mortality attributable to the collective effects of the action and any cumulative effects.

NMFS has determined that WDFW and ODFW has adequately addressed the criteria for limit 4 of the final 4(d) rule for LCR salmon and steelhead and CR chum salmon (50 CFR 223.203(b)(4)) (see attached ERD documents). The complete analysis of biological impacts from the proposed fisheries are fully described in section 2 "Effects on ESA-listed Salmonids" of the FMEPs. NMFS evaluated the fishery impacts on listed juvenile and adult salmon and steelhead in section (D) of the ERDs. Below is a summary of NMFS' findings.

5.1.1 Steelhead

WDFW and ODFW have implemented restrictive regulations permitting the retention of marked adult hatchery steelhead only and requiring the release of naturally produced adult steelhead (ODFW 2000; ODFW 2001a; WDFW 2003). All hatchery steelhead released in the action area are externally marked with an adipose fin-clip to allow for these selective fisheries. As described in the FMEP, WDFW will manage the tributary harvest of summer and winter steelhead stocks in the action area not to exceed a maximum harvest rate of 10% of the natural spawning population, although the actual impacts are expected to be closer to 5% (WDFW 2003). The WDFW will manage the Washington summer steelhead populations of the LCR ESU above Bonneville Dam, at a maximum harvest rate estimated to be 5%. The reduced harvest rate for these populations is to account for impacts from passage at Bonneville Dam, research activities and Treaty Indian fisheries in the Bonneville Pool. These impacts are discussed in the WDFW FMEP (WDFW 2003).

As described in the ODFW steelhead FMEPs (ODFW 2000; 2001a), ODFW estimates that in its steelhead fisheries, impacts on listed steelhead will be from 0% to 2.5%. The differences between WDFW and ODFW fisheries impact estimates reflect stock specific encounter rates and assumptions of catch and release moryalities. The encounter rate is the proportion of the natural run of steelhead that may be caught and released during the fisheries (see section 1.4. of the FMEPs). Assumptions regarding hooking or catch and release mortalities are also discussed in this section of the FMEP. To be conservative, WDFW and ODFW have used encounter rates and catch and release mortality estimates that are higher than the actual data support, as described in the FMEPs. These conservative assumptions are used such that the actual harvest impacts will not likely exceed the fishery impact estimates. The fisheries impact estimates also include estimates for non-compliance (poaching), which is expected to be very low.

The FMEPs also describe fishery impacts on juvenile steelhead from the tributary fisheries and the measures taken to minimize harvest impacts. These fisheries include fisheries for resident trout, warmwater species and other anadromous species (e.g. salmon, shad, whitefish, smelt). As discussed in the FMEPs and analyzed in the ERD documents, WDFW and ODFW have implemented a number of measures in recent years to minimize fishery impacts on listed juvenile steelhead. These measures are described in section 2 of the FMEPs (ODFW 2000; ODFW 2001a; WDFW 2003). The measures include opening the trout season from June to October, minimum size limits, two fish bag limits, selective gear restrictions, area closures and the end to the release of catchable trout into anadromous waters. The June opening and the 8 inch minimum size limit protect out migrating juvenile steelhead and salmon smolts. In larger mainstem areas the size limit is increased to 12 inches to protect larger out migrating steelhead smolts. Gear and area restrictions provide protection for rearing juvenile steelhead. As described in the FMEPs the estimated impacts on juvenile steelhead from all the tributary fisheries is expected to be less than 1% (ODFW 2000; ODFW 2001a; WDFW 2003).

NMFS reviewed the analysis of fisheries impacts by WDFW and concurs with their determination that the proposed steelhead fisheries will not appreciably reduce the likelihood of survival and recovery of the LCR steelhead ESU in the wild (NMFS 2003a). The WDFW used a stock recruitment analysis to define the relationship between spawners and recruits for Kalama River steelhead. The Kalama River winter and summer steelhead stocks were used to represent steelhead populations in the Washington portion of the ESU because of the long term data set collected for these populations. WDFW used the most conservative assumptions in this spawner recruit model including: (1) using a model with a lowest rate of intrinsic productivity, (2) estimated extinction and Maximum Sustainable Yield (MSY) harvest rates under the lowest range of smolt to adult survival within the data set, and (3) set harvest rates below MSY, which by definition should be sustainable. These assumptions and a description of the approach used in their analysis are in section 2 of the FMEP (WDFW 2003).

This analysis was used to calculate extinction harvest rates for summer and winter steelhead in the Kalama River. Extinction harvest rates in this context were defined as harvest from all sources including fisheries, research, and habitat degradation, that if continued will eventually lead to extinction. For extinction to occur, harvest rates above the threshold must occur for 10 generations or 50 years. These threshold rates were 37% for Kalama summer steelhead and 56% for Kalama winter steelhead. These threshold rates were developed for years of average ocean productivity, but if harvest rates exceed these levels during low ocean productivity for more than a generation, the survival and recovery of the species would be in jeopardy. These threshold harvest rates were also calculated during low ocean productivity and these were 22% and 37% for Kalama summer and winter steelhead, respectively. WDFW determined that for these populations, the modeling suggested that the probability of extinction was essentially zero as long as fisheries mortality rates remained less than these levels. The actual harvest rates are expected to be approximately 5%, (see the ERD on WDFW's FMEP (NMFS 2003a)).

The harvest mortality rate for winter steelhead populations above Bonneville Dam is expected to be approximately 10%. However, summer steelhead populations from the LCR steelhead ESU that occur above Bonneville Dam are additionally impacted by the operation of Bonneville Dam, fisheries research, and mainstem harvest. Due to these impacts, the WDFW has closed the Wind River above Shipherd Falls (river mile 2) since 1996 and believes harvest impacts on Wind River summer steelhead should be managed not to exceed 4%. Since no changes in fisheries management for steelhead are proposed if the listed populations rebound to healthy abundance levels (i.e., selective fisheries for hatchery fish only will continue), harvest rates should not increase beyond the management limits proposed by the WDFW.

At these proposed harvest levels, which are well below the levels that would lead to extinction, the WDFW model results show that harvest mortality has an almost zero chance of causing extinction in 50 years. Thus, the proposed fisheries management for steelhead by WDFW should not appreciably reduce the likelihood of survival and recovery of the listed populations.

The ODFW also modeled the effects on the long-term extinction risk for steelhead populations, from fishery impacts higher than those proposed in the FMEP (ODFW 2000; ODFW 2001a). ODFW found that the probability of extinction for nearly all of the 27 steelhead populations that were modeled was zero when total annual harvest rates were restricted to 20% or less (Chilcote 2001). Once harvest impacts increase above 20%, the risk of extinction increases substantially for many populations. Though not modeled, NMFS believes that the Hood River steelhead populations would show a similar trend. The total expected fisheries mortality on naturally produced Hood River steelhead (Columbia River mainstem commercial, mainstem sport, and tributary sport fisheries) is expected to be less than 10% of the naturally produced summer and winter steelhead annually (ODFW 2000). Harvest of Hood River steelhead only occurs in the lower 4.5 river miles below Powerdale Dam protecting holding and spawning listed steelhead. The expected fisheries mortality on naturally produced LCR steelhead in all the mainstem fisheries (commercial and mainstem recreational) and tributary fisheries is expected to be less than 5% of the naturally produced winter steelhead annually (ODFW 2001a). The proposed impact levels from in- and out-of-basin fisheries are substantially lower than the modeled levels at which extinction risks increase, and are at levels where the risk of extinction is essentially zero. Thus, the proposed fisheries management in the Hood River basin should not appreciably reduce the likelihood of survival and recovery of the listed steelhead populations.

The harvest rates for the other LCR steelhead populations in Oregon are expected to be below 5% of the naturally produced population annually. Again, at these rates of harvest mortality the risk of extinction is essentially zero and thus the proposed fisheries are not expected to appreciably reduce the likelihood of survival and recovery of the listed populations.

The proposed 5% to 10% fisheries mortality rates for naturally produced LCR steelhead are a substantial reduction compared to past harvest rates. ODFW and WDFW estimate that during the period prior to listing, the combined adult and juvenile fisheries mortality rates for LCR steelhead approached 50%. This was before adult harvest was restricted to only marked steelhead and before changes in resident trout fishing regulations. The biggest reduction in harvest impacts came from the changes in resident trout fisheries (see ODFW 2000; ODFW 2001a; WDFW 2003). Resident trout fisheries used to open in April, had a 6-inch minimum size limit, and allowed the use of natural bait. This management regime exposed out migrating steelhead juveniles to high harvest rates. The other major change was the elimination of releases of catchable size hatchery trout into anadromous waters. Evidence has shown that after these catchable trout were harvested, harvest would be concentrated on naturally produced juvenile steelhead, reducing the number of potential smolts out migrating the following year. In fisheries for adult steelhead, the use of bait is steelhead permitted, to protect juvenile steelhead ODFW and WDFW have establishment sanctuaries in spawning and rearing areas where fisheries for adult steelhead are prohibited. Many of the benefits from the reduction in juvenile mortality from the regulation changes have not yet been fully realized because the regulation changes were not implemented until 2000-01. These measures have reduced fisheries mortalities of juvenile steelhead to around 1% of the naturally produced juvenile population.

NMFS concurs that the proposed fishery actions in the FMEPs are not likely to appreciably reduce the likelihood of survival and recovery of the Hood River steelhead populations (ODFW

2000), other LCR steelhead populations or the LCR steelhead ESU (ODFW 2001a; WDFW 2003).

5.1.2 Spring Chinook Salmon

NMFS looked at a number of factors that were instrumental in concluding the proposed fisheries in the WDFW and ODFW FMEPs (ODFW 2003; WDFW 2003) will not appreciably reduce the likelihood of survival and recovery of the LCR spring chinook salmon populations. First, tributary fishery impacts will be substantially reduced under the selective fishing regime established in the FMEPs. Spring chinook salmon harvest rates have averaged 67%, 42% and 30% for the Lewis, Kalama, and Cowlitz spring chinook salmon fisheries, respectively, during periods when hatchery fish were abundant (see Figure 4 in the WDFW FMEP (WDFW 2003)). As these stocks declined in the 1990s, fisheries restrictions reduced harvest. The new selective fisheries for spring chinook salmon will reduce natural spring chinook salmon harvest rates to less than 10% and will generally average closer to 5% (see Table 12 in WDFW FMEP). WDFW does not propose selective fisheries for spring chinook in the Wind River because all of the returning spring chinook salmon in this basin are hatchery returns, therefore marked only retention of spring chinook salmon does not apply (WDFW 2003).

ODFW, by implementing a selective fishery for hatchery spring chinook in the Sandy Basin, has reduced the estimated impact rates by over 85% from historical levels. Prior to selective fishing being implemented in 2002, harvest rates on wild spring chinook in the Sandy River were approximately 40%. Since 2002, under the selective fishing regulations, fisheries impacts on naturally produced spring chinook are expected to be around 8.6% per year (ODFW 2003).

NMFS, in its biological opinion addressing the Pacific Salmon Treaty (NMFS 1999b), concluded that under the new Pacific Salmon Treaty agreement overall exploitation rates for LCR spring chinook would decline from the base period (1980-1992 brood years) but the large terminal harvest incorporated into the analysis would mask the reductions in the ocean fisheries. NMFS further identified that spring chinook salmon populations in the Washington tributaries are limited by the absence of suitable habitat so that it was appropriate to manage terminal harvest to ensure that hatchery escapement goals are met. This would protect the remaining genetic legacy of these populations until future recovery measures are identified. The selective fisheries for spring chinook salmon are expected to further reduce impacts from harvest in the tributaries or terminal areas, thus further ensuring that hatchery escapement goals are achieved. In the future, if adult returns increase, fishery impacts to naturally produced adults are expected to remain the same as selective fisheries will remain in place. This long term management goal is expected to ensure that natural escapement goals are achieved for tributaries in Washington and Oregon. The 100% marking of all hatchery spring chinook salmon in the Cowlitz, Lewis, Kalama, and Sandy River basins that allows for selective fisheries also allows WDFW and ODFW to better determine the status of the natural populations in these basins through visual examination of spring chinook salmon collected at traps and weirs and from carcasses collected on the spawning grounds.

Another factor that NMFS considered in its determination on the WDFW FMEP (WDFW 2003) and ODFW's chinook salmon FMEP (ODFW 2003) was the analysis completed by ODFW for Sandy River spring chinook salmon (ODFW 2003). In it, ODFW used a Population Viability Analysis (PVA) model that was based on risk assessment survival and recovery likelihoods consistent with those identified in the Upper Willamette River (UWR) spring chinook salmon FMEP (ODFW 2001c). The PVA model was used to assess the extinction risk and recovery potential of listed fish under different fishery management regimes using a systematic, biologically based risk assessment model. The model incorporates natural variability in survival at different life stages, ocean harvest, freshwater harvest, stock productivity, and habitat capacity to derive extinction and recovery probabilities. The risk assessment results are conservative because they are based on worst-case productivity assumptions. Actual productivity is probably greater and is expected to continue improving in the future as natural stocks benefit from reduced hatchery influences. The PVA model identified 30% as the impact rate limit for the Sandy River spring chinook salmon rather than the 15% derived for the UWR spring chinook salmon. According to ODFW, "[t]he Willamette limit was less because the Santiam River and McKenzie River populations are subject to significant conversion mortality in the upper Willamette to which Sandy River spring chinook salmon are not exposed. Recent wild fish escapements in the Sandy River were also greater than starting population sizes for upper Willamette populations." Harvest impacts less than the 30% limit identified in the model are expected to have < 0.1% chance of falling below the quasi-extinction level of an escapement of 300 naturally produced adults in 30 years. Freshwater fishery impacts on Sandy River spring chinook salmon are expected to be around 8.6%, well below the harvest impact limit of 30% identified by the PVA model. Sandy River spring chinook salmon are the only other natural spawning population of spring chinook salmon in the LCR ESU.

Based on the above information, the risks from fishing are substantially reduced under the FMEPs for the populations of spring chinook in the LCR chinook salmon ESU. The harvest rates for the other LCR spring chinook populations in Oregon are expected to be 8.6% of the naturally produced population annually. Again, at these rates of harvest mortality, the risk of extinction is essentially zero and thus the proposed fisheries are not expected to appreciably reduce the likelihood of survival and recovery of the listed populations. The outlook for conserving and recovering these populations is much improved when compared to the past harvest management.

5.1.3 Bright Fall Chinook

In the ESU, there are two populations of late returning "bright" fall chinook, located in the Lewis River and in the Sandy River. As described in the WDFW FMEP, the escapement objective for Lewis River fall chinook salmon has been established at 5,700 adults based on productivity and habitat constraints (McIsaac 1990). This escapement goal was supported by a separate analysis that identified the goal as 5,800 adults (Peters *et al*. 1999). This stock is also a Pacific Salmon Treaty indicator stock and is carefully monitored to ensure adequate escapement. Because this is an indicator stock, all fisheries will be managed to ensure that the 5,700 escapement goal is attained annually. This is a healthy fall chinook salmon stock with an intrinsic productivity near 11 (McIsaac 1990), an escapement goal of 5,700 wild fish that has been met in almost all years (estimated escapement in 2001was 15,000), and the population has a low number of hatchery spawners.

The ODFW FMEP describes the fishing regulations in the Sandy River which have been reformed in recent years to help protect naturally spawning fall chinook. No harvest of unmarked, wild fall chinook is allowed. Since no hatchery fall chinook are released into the Sandy Basin, directed fishing for fall chinook has been eliminated. All of the fishery impacts on fall chinook are now from catch and released by anglers targeting other fish species in the lower Sandy River – primarily hatchery coho salmon and summer steelhead. The fishing season for coho salmon ends October 31st. No fishing for coho or chinook salmon is allowed during the peak spawning period for Sandy River bright fall chinook salmon in December and January. Since this time period is also in between the peak return timing of summer and winter steelhead, fishing effort is relatively low while the brights are spawning in the lower Sandy River. Incidental catches of fall chinook are low during this season (ODFW 2003).

ODFW estimated the Sandy River sport fisheries resulted in an impact rate to bright fall chinook salmon in the range of 2 to 4% (ODFW 2003). These estimates assumed that fall chinook angling still occurred and thus represent a high end estimate, since fall chinook angling was eliminated in 2002. Nearly all of the fishery impacts in freshwater occur from fisheries in the mainstem Columbia River. Mainstem Columbia River fisheries are governed by section 7 consultations between NMFS and the parties of *U.S. v. Oregon* and are managed to meet Lewis River bright fall chinook escapement goals. Based on the above regulation changes and the above assessment, fisheries occurring in the action area as described in the FMEP will not appreciably reduce the likelihood of survival and recovery of the late fall bright stocks of chinook in the LCR chinook salmon ESU.

5.1.4 Tule Fall Chinook Salmon

It has been difficult to evaluate the fisheries management regime proposed in the FMEPs for the early fall tule stocks of chinook salmon in the action area (ODFW 2003; WDFW 2003). Every native tule chinook population of the ESU has been altered from its historic state by hatchery programs, high harvest rates, habitat loss, and habitat degradation. Hatchery programs in the Lower Columbia have released large numbers of fish from non-indigenous stocks for over 50 years in most of these rivers. The vast majority of these hatchery fish (>95%) have not been marked, so it is not possible to differentiate between hatchery- and natural-origin fish spawning in the tributaries (NMFS 2000c). These hatchery practices have masked (and continue to mask) the status of any remnant runs of naturally produced tule fall chinook throughout the ESU. Lastly, tule fall chinook have been subjected to very high harvest rates in ocean and freshwater fisheries. These fisheries are designed to harvest abundant hatchery chinook and healthy stocks of chinook returning to the Oregon Coast, Washington Coast, and the Hanford Reach of the Columbia River. Because the tule stocks commingle with most of these other stocks, the tules are subjected to intense harvest regimes in these mixed stock fisheries.

The discussion of the above issues is not intended to diminish the importance of conserving and recovering tule stocks throughout the ESU. These populations are listed under the ESA.

However, evaluation of the tributary fisheries must be put in the context of the other important factors outside of the scope of ODFW's and WDFW's FMEPs. These FMEPs are not expected to result in much improvement to the long-term health of the tule chinook populations in the LCR ESU because of the other larger factors, even if all tributary fisheries were closed. Meaningful reforms of hatchery management will have to be accomplished through section 7 consultations between the hatchery operators and NMFS. Any changes to harvest management to help protect tules will have to be done via section 7 consultations with PFMC for ocean fisheries and the parties of *U.S. v. Oregon* for estuary and mainstem Columbia River fisheries.

Impacts on tule fall chinook from the tributary fisheries varies substantially depending on the river. Table 3 in the WDFW ERD document (attached) illustrates the different management approaches for tributary fall chinook salmon fisheries in different basins. In all the other tributaries not listed in Table 3 and within the Washington portion of the action area, retention of fall chinook is prohibited. Tributary harvest of tule fall chinook in the basins in Table 3 are still overshadowed by the harvest in the Lower Columbia River mainstem sport and commercial fisheries. The Lower Columbia River mainstem fisheries are outside the scope of the FMEPs. Mainstem fisheries are governed by section 7 consultations between NMFS and the parties of *U.S. v. Oregon*.

Two fishery management regimes are proposed in the WDFW FMEP for tule fall chinook. The first regime is to prohibit any harvest of wild tule chinook in the tributaries. This is accomplished by prohibiting angling during the period when peak spawning of tule fall chinook salmon occurs in the tributaries (Table 3 of the WDFW ERD document) or by prohibiting any harvest of wild chinook. This type of management regime is used in watersheds where hatchery fall chinook salmon are not released. In these tributaries, fishery impacts on fall chinook populations are non-existent during the fishing closures or low (likely much less than 2%) because impacts are solely from fish being caught and released (WDFW 2003).

ODFW uses the same approach of prohibiting any harvest of wild tule chinook in the tributaries. This is accomplished by prohibiting angling during the period when peak spawning of tule fall chinook salmon occurs in the tributaries (i.e. Big Creek, Scappoose Creek, Columbia River Gorge tributaries) or by prohibiting any harvest of wild chinook year round (i.e. Clackamas and Sandy Rivers). See Table 3 of the ODFW chinook ERD document (attached) for further information on the fishing seasons in all of the management units. In these tributaries, fishery impacts on fall chinook are non-existent during the fishing closures or low (likely much less than 2%) because impacts are solely from fish being caught and released. The catch and release fisheries are in the Clackamas and Sandy Rivers. The fisheries when tule fall chinook are present in these rivers have very low effort because no fin-clipped chinook are present in the fall so harvest opportunities do not exist. The Sandy River also closes October 31st to chinook salmon angling. Fishing pressure after this closure reduces substantially to a few anglers targeting hatchery steelhead in between the summer and winter runs that normally peak in June and January, respectively.

The second approach is for those remaining tributaries that allow fall chinook to be harvested, these fisheries will be managed to meet natural spawning and hatchery broodstock escapement goals and not to exceed the Rebuilding Exploitation Rate (RER) for tule fall chinook salmon. Data on LCR fall chinook salmon is insufficient for a formal risk assessment based on PVA. As a result, WDFW and ODFW has adopted the RER established by NMFS for LCR tule fall chinook salmon fishery impacts that occur in fisheries regulated by the PFMC (NMFS 2002, Simmons 2002). The rebuilding exploitation rate, by definition, does not appreciably reduce the likelihood of survival and recovery of these fish. There are four steps involved with determining population specific RERs: (1) identify populations, (2) set critical and viable abundance levels, (3) estimate population productivity as indicated by a spawner-recruit relationship, and (4) identify appropriate RERs through simulation. The RER for tule fall chinook salmon was set at 49% in 2002 (this is a reduction from 65% used in 2001). As seen with the recent change, the RER is subject to change as new recruitment data is incorporated into the models. The tributary fisheries will be managed according to the most recent RERs determined by NMFS for the PFMC in the North of Falcon process.

As described in the FMEPs, ODFW and WDFW will manage fisheries with the goal of not exceeding the maximum harvest rate (49% in 2002). WDFW fall chinook salmon tributary harvest rates are usually less than 10%. The ODFW FMEP states that the tributary fisheries for the Coast Range, Cascade, and Columbia Gorge tule management units will be managed as to not exceed the RERs in place for that run year. In the future, as more RERs are developed for other populations and refined, the FMEPs will adopt those RERs into the management of the tributary fisheries (see Table 8 of the ODFW FMEP). The new and modified RERs are expected to reflect changes and approaches developed in recovery planning processes.

It should be noted that the RER for LCR tule fall chinook salmon is based on the Coweeman River (a tributary to the Cowlitz River) tule fall chinook salmon population. The Coweeman stock of fall chinook salmon is a moderately sized population with a current average escapement of 600 adults but has ranged over the past 10 years from a high of 2,148 to a low of 93 adults. NMFS believes that using the Coweeman stock RER for the management of other tule stocks in the ESU is not ideal. The Coweeman stock occupies a relatively small basin, but the population there is moderately healthy and self-sustaining and there is little influence from hatchery fall chinook. This stock is being used as an indicator stock for naturally produced LCR tule fall chinook salmon because of the long trend in escapement data and because of the minimal influence of hatchery fall chinook salmon spawners. This population may not be representative of all the tule populations in the LCR ESU, but if the RER for the Coweeman fall chinook salmon population is achieved then it can be expected that there would be adequate protection for the other natural tule fall chinook salmon populations. The Coweeman fall chinook population does represent those tule fall chinook salmon populations in the ESU that are not influenced by hatchery fish (i.e., Grays River fall chinook) and are self sustaining. However, it does not represent those smaller tule populations that are not as productive (i.e., gorge tributary populations). For these populations, fisheries impacts on fall chinook salmon are minimized by area closures, modified seasons and limited to impacts from catch and release during fisheries targeting other species. Recovery planning processes will included estimates of harvest impact levels that these smaller populations can sustain while still ensuring recovery.

The approach of using RERs to guide tule fall chinook impacts in the Washington tributaries appears to be prudent now for the following reasons. The tributaries that allow fall chinook harvest are dominated by hatchery-origin returns (Table 3 of the ERD); and the harvest of fall chinook in these tributaries is low and represents far less than 10% of the total harvest in ocean and mainstem Columbia River fisheries.

Similarly, the approach of using RERs to guide tule fall chinook impacts in Oregon tributaries appears to be prudent now for the following reasons. The tributaries that allow fall chinook to be harvested are dominated by hatchery-origin returns (Table 3 of the ODFW Chinook ERD; Myers *et al.* 2002). The harvest of fall chinook in these tributaries is low and represents far less than 10% of the total harvest in ocean and mainstem Columbia fisheries (Table 5 of the ODFW Chinook ERD). The notable exception is the Hood River. Available information suggests a remnant population of natural-origin tule chinook still exists in the Hood River (Myers *et al.* 2002; ODFW 2003). However, it is not clear how many of the presumed natural-origin fish may be strays from the Spring Creek Hatchery fall chinook salmon releases which are not marked. This hatchery is located across the mainstem Columbia River from the mouth of the Hood River and it is very likely that hatchery fish stray into the Hood River. Catch card information reports a relatively low number of fall chinook harvested (19 fish from 1985 to 1998) in the Hood River (Table 5 of the ODFW Chinook ERD). However, given the average escapement of 20 adult fall chinook salmon to Powerdale Dam (rm 4.5) from 1992 to 1999 (Table 7 of the ODFW chinook FMEP), even a low number of harvested fish represents a substantial percentage of the population returning to this tributary. In recent communications with ODFW (Rod French email September 23, 2003), they provided data from the intensive creel surveys that have been conducted in the Hood River below Powerdale Dam as part of the Hood River Production Program. The data showed that in 2000, 2001, and 2002 a total of 34 adult chinook were caught but on 2 where retained. ODFW has agreed with NMFS' position that even though the harvest of fall chinook is low (2 fish in the last 3 years), this population is very important to the recovery of the LCR chinook salmon ESU because it represents one of the few potentially self-sustaining tule fall chinook populations above Bonneville Dam. ODFW has proposed to change the regulations in the Hood River basin to a marked only fishery for chinook salmon beginning in 2004.

WDFW and ODFW are working with other agencies to development economical methods to mass mark fall chinook salmon. Currently the size of fall chinook salmon juveniles at release and the numbers released make mass marking of fall chinook difficult and expensive, as compared to spring chinook salmon and steelhead. When a method is developed to mass mark fall chinook salmon, then selective fisheries can be implemented for hatchery fall chinook salmon. The reduction in fisheries mortalities for fall chinook should be equal to what is now observed in spring chinook and steelhead fisheries.

The proposed management objective for the tule fall chinook salmon fisheries occurring in the action area is to not exceed the RERs developed by NMFS. Based on the analysis and the proposed management, the fall chinook fisheries should not appreciably reduce the likelihood of survival and recovery of the tule fall chinook salmon stocks in the LCR chinook salmon ESU.

5.1.5 Chum Salmon

Total escapement and harvest estimates are not available for LCR chum and without these it was not possible to establish an RER for any population of this ESU. Although an RER was not identified for LCR chum, WDFW analyzed the 8.3% RER derived by NMFS for Hood Canal summer chum salmon (NMFS 2000d). This rate is well below the harvest rate that could be derived if the chum salmon data from the meta-population analysis by Myers *et al.* (1999) was used. WDFW expects harvest impacts to be less than 4% for Washington tributary fisheries because WDFW has eliminated the direct harvest of natural adult chum salmon in the fisheries through the use of selective fisheries that require anglers to release chum salmon and through the use of time and area closures to establish sanctuaries, which are closed to fishing. WDFW estimates that the harvest rate impact will be limited to the incidental catch and release of chum salmon during tributary fisheries targeting other species. This is similar to the impacts on chum salmon expected by ODFW in the Oregon tributaries to the lower Columbia River (ODFW 2001b). Currently, the incidental catch of chum salmon in the lower Columbia mainstem commercial and recreational fisheries is limited to a few tens of fish per year (NMFS 2002b). The harvest rate in the proposed mainstem fisheries is expected to be 1.6% and is almost certainly less than 5% of the total population abundances. The harvest rate in the ODFW proposed tributaries fisheries is expected to be 0.5% of the total population abundance and is almost certainly less than 2% (ODFW 2001b).

McClure *et al.* (2000) calculated the population growth rate (lambda) for the Columbia River chum salmon ESU. Lambda values were based on population trends observed in the period from 1980 through 1998 in the mainstem and west fork Grays River, Crazy Johnson Creek, and in Hamilton Creek. NOAA's Northwest Fisheries Science Center (NWFSC) estimated that the lambda value for Columbia River chum salmon populations over this base period was 1.04, indicating that the population levels are stable, though not markedly increasing, and that there is little short or long-term risk of extinction or dangerous decline. Columbia River mainstem harvest rates during the 1980's and early 1990's were greater than current harvest rates (ODFW and WDFW 2000). Based on these considerations, NMFS concludes in its ERD document that the impacts associated with these FMEPs are not likely to appreciably reduce the likelihood of survival and recovery of Columbia River chum salmon.

5.1.6 Other Anadromous and Non-Anadromous Species

The WDFW and ODFW FMEPs also address fisheries that do not target salmon and steelhead and are not part of the PFMC and *U.S. v. Oregon* managed fisheries. The effects of these fisheries are described in section 2 of the FMEPs. The fisheries for other species may occur year-round within the action area or concurrently with salmon and steelhead seasons. Many of these fisheries, however, are concentrated after the spring runoff when flows and warmwater temperatures permit successful angling. Fisheries generally occur in the lower sections of some LCR tributaries for warmwater game species including largemouth bass, smallmouth bass, channel catfish, crappie, bluegill, carp, and northern pikeminnow. The whitefish fishery is not a major fishery in the LCR and no specific regulations or special seasons are implemented. Warmwater fisheries also occur in standing waters throughout the basin. Chinook, chum, and steelhead impacts in warmwater fisheries are believed to be nil. In the LCR tributaries, warmwater fisheries are concentrated in backwaters and sloughs, which are not hospitable rearing areas for juvenile salmonids. Chinook and chum salmon and steelhead are not present in standing waters where warmwater fisheries occur. Fisheries are also most active during warm summer months after spring migrant juvenile chinook salmon and chum have left the system and before fall migrant juvenile chinook salmon disperse downstream from rearing areas. Since warmwater species potentially prey on and compete with juvenile salmonids, warmwater fisheries could actually provide some benefit to listed salmon and steelhead.

Shad fisheries are opened in the action area tributaries and the fishery effort is believed to be low. Shad fishing occurs from May through July. The onset of the shad run coincides with the tail end of the spring chinook salmon fishery and the summer steelhead fishery. The impacts are included in the analysis of the spring chinook salmon and summer steelhead fishery impacts. The recreational shad fishery is open year-round with no bag limits.

Small sturgeon fisheries occur in the LCR tributaries. Most of the effort is concentrated in the lower Cowlitz and Willamette Rivers. The fishery is generally open year-round and legal sturgeon retention sizes are 42 to 60 inches. Sturgeon anglers fish with bait on the bottom and use very large hooks to catch these large fish. Salmon and steelhead impacts in sturgeon fisheries are believed to be zero.

A smelt fishery occurs in the lower Columbia River in the Sandy River and Washington tributaries. Tributary smelt fisheries are limited to dip nets and the most popular fishery occurs in the Cowlitz River. The few adults present during this time easily avoid the gear. Juvenile salmon and steelhead are not migrating at the times and places smelt fisheries occur.

Located in Table 12 of the WDFW FMEP are descriptions of the estimated take of listed fish in various tributary fisheries. The table describes impacts from fisheries including the fisheries targeting con-specific hatchery fish, resident trout and others (whitefish and warmwater species). All these fisheries reflect a wide range of impacts on the various listed species depending on the tributary and the species present. All these fisheries impacts are below the maximums identified by WDFW for each of the listed species. Harvest at these rates is not expected to appreciably reduce the likelihood of survival and recovery of any of the ESUs in the action area.

It is important to note that if natural populations of salmon and steelhead increase in abundance, WDFW and ODFW plan to continue the selective fisheries for hatchery fish that are currently described in the FMEPs. This action will ensure that when large escapements of natural fish do occur they will be allowed to spawn naturally and potentially fully seed the natural habitat. At the other extreme, WDFW and ODFW propose to further reduce fisheries mortalities if returns of naturally produced fish are expected to be below minimum escapement levels. Harvest measures include reductions in the bag limits, shortening the season, area closures and even closing the fishery completely (see Attachments 1-5 for more details).

5.2 Cumulative Effects

Cumulative effects include the effects of future state, tribal, local or private actions not involving Federal activities that are reasonably certain to occur within the action area subject to this consultation. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Act.

State, Tribal and local government actions will likely to be in the form of legislation, administrative rules or policy initiatives. Government and private actions may include changes in land and water uses, including ownership and intensity, any of which could impact listed species or their habitat. Government actions are subject to political, legislative and fiscal uncertainties. These realities, added to the geographic scope of the action area which encompasses numerous government entities exercising various authorities and the many private landholdings, make any analysis of cumulative effects difficult and speculative. The FCRPS Opinion describes in detail a number of actions segregated into State, Local, Tribal and Private categories (NMFS 2000a). The actions listed are, in general, applicable to this Opinion where they occur in the action area, and are expected to continue into the future.

Non-federal actions are likely to continue affecting the listed species. The cumulative effects in the action area are difficult to analyze considering the large geographic scope of this Opinion, the political variation in the action area, the uncertainties associated with government and private actions, and the changing economies of the region. Whether these effects will increase or decrease is a matter of speculation; however, based on the trends identified in this section, the adverse cumulative effects are likely to increase. Although state, Tribal and local governments have developed plans and initiatives to benefit listed fish, they must be applied and sustained in a comprehensive way before NMFS can consider them "reasonably foreseeable" in its analysis of cumulative effects.

5.3 Integration and Synthesis of Effects

In the environment baseline discussion (above), harvest was identified as one of factors contributing to the decline of the LCR chinook salmon, LCR steelhead and CR chum salmon ESUs, leading to their listing as "likely to become endangered in the foreseeable future." In the FMEPs, ODFW and WDFW identify the current harvest management regime that reflects the changes in the fisheries prior to and since the listing that address fisheries impacts on the listed salmon and steelhead.

Impacts to naturally produced salmon and steelhead from the proposed fisheries in the FMEPs show a substantial reduction from fisheries impacts observed in the past. Steelhead fisheries in Oregon and Washington were estimated to have killed 50% of the naturally produced population

(Cramer *et al.* 1997). The majority of this mortality was on juvenile steelhead and occurred in the resident trout fisheries. The fisheries management regimes described in these FMEPs will reduce fisheries mortalities for adult and juvenile steelhead combined to less than 5%. This is a ninety percent reduction in impacts. Fisheries regulations protecting juveniles steelhead were implemented only a few years ago and it is only now that the effects of these changes are being observed. For example, the out migration of juvenile steelhead from the upper Clackamas River basin has increased substantially since the end of catchable trout stocking, and the reduction in fishing effort due to season and gear changes.

Modeling and analysis by ODFW and WDFW, as described in detail in the FMEPs, have shown that the proposed levels of fisheries mortalities for LCR steelhead are expected to not appreciably reduce the likelihood of survival and recovery of the listed populations (see the discussion above and in the WDFW and the ODFW steelhead ERD documents).

Fisheries impacts on LCR spring chinook salmon have also been reduced since the listing. Harvest rates as a proportion of the annual spawner abundance have dropped from an average of 67%, 42%, and 30% for the Lewis, Kalama and Cowlitz spring chinook salmon fisheries, respectively, to an expected harvest rate of between 5% and 10%. Harvest rates for the Sandy River spring chinook population are expected to drop from 40% to approximately 8.6% per year. This decrease is due to the shift to selective fisheries which has only been possible in the entire action area since 2002 when all returning hatchery spring chinook were externally marked. Modeling of spring chinook populations by ODFW (see ODFW chinook FMEP) and by the PFMC has shown that the proposed fisheries impacts are well below those that would appreciably reduce the likelihood of survival and recovery of the spring chinook populations.

LCR bright fall chinook salmon should continue to benefit from the fisheries management actions in the FMEPs. Currently, the Lewis River population of bright fall chinook salmon is managed to meet an escapement goal that has been determined to be sustainable (see description in WDFW FMEP). In the Sandy River, the bright fall chinook population is protected by regulations requiring the release of unmarked salmon and through season and area closures. Tributary fisheries impacts are expected to decline to 2% to 4% for this population.

Fisheries impacts on tule fall chinook salmon stocks are expected to decline under the fishery management in the FMEPs. As described above and in the FMEPs, naturally produced tule fall chinook salmon will be protected through season and area closures and through fisheries requiring the release of unmarked chinook salmon. Other populations are expected to benefit from fisheries managed to meet hatchery broodstock needs, natural escapement goals and through management of the fisheries not to exceed the Rebuilding Exploitation Rate for tule fall chinook salmon. Fisheries impacts on some tule populations have declined from over 65% to less than 49% of the natural spawner abundances, and some have seen even greater reductions (ODFW and WDFW FMEPs). Impacts are expected to decrease as RERs are developed and modified by NMFS during the PFMC ocean salmon season setting process. Fisheries mortalities in the tributary fisheries would be expected to decrease further when mass marking of hatchery fall chinook is perfected. Mass marking will permit the use of selective fisheries to harvest marked hatchery fall chinook salmon.

Fisheries impacts on chum salmon in the lower Columbia River are expected to be minimal, because there are no directed fisheries for chum salmon and the only impacts will come from catch and release of chum salmon in fisheries targeting other species. Chum salmon are also protected by regulations requiring the release of all chum salmon and by area closures that protect spawning chum salmon (WDFW 2003; ODFW 2001b).

In reviewing the information provided above and in the attached ERD documents, recent harvest management changes have substantially reduced the effects of fisheries mortalities (harvest) on listed LCR salmon and steelhead. Modeling exercises by WDFW and ODFW have shown that the proposed fisheries mortality rates for spring chinook and steelhead are well below levels that would be expected to appreciably reduce the likelihood of survival and recovery for the listed populations. The extinction fisheries mortality rates developed by WDFW and ODFW are conservative given the assumptions used in the models. WDFW and ODFW selected stock-recruitment functions that represented conservative estimates of innate productivity for the naturally produced populations and low ocean productivity (see attached ERD documents for a detailed discussion as well as the FMEPs). The proposed management regimes should not appreciably reduce the likelihood of survival and recovery for the listed chum populations.

In the FMEPs, WDFW and ODFW describe monitoring and evaluation activities that are designed to measure performance indicators for population status and fisheries impacts. These performance indicators will be monitored and reported to NMFS in an annual report. WDFW and ODFW will also conduct comprehensive reviews of the FMEPs at least every 5 years. Fisheries management actions can also be changed as new information is provided by NMFS (through the PFMC process), from the Technical Recovery Teams, and as the result of subbasin planning. NMFS will be notified by WDFW and ODFW prior to any decisions regarding modifications to fishing regulations. These reporting measures will help ensure that fisheries are complying with the management regimes in the FMEPs.

5.4 Conclusion

After reviewing the current status of the threatened ESUs under consultation, the environmental baseline for the action area, the effects of NMFS concurrence with the proposed fisheries actions under 4(d) limit 4, and cumulative effects, it is NMFS' biological opinion that concurrence with the FMEPs is not likely to jeopardize the continued existence of the threatened ESUs under consultation.

6. INCIDENTAL TAKE STATEMENT

With NMFS' approval of the FMEPs, ESA take prohibitions will not apply to activities conducted pursuant to the FMEPs. Therefore, the federal action of approving the FMEPs also is not subject to take prohibitions. Accordingly, no incidental take statement has been prepared.

7. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of threatened and endangered species. Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on listed species, to minimize or avoid adverse modification of critical habitat, or to develop additional information.

NMFS has no additional conservation recommendations regarding the actions addressed in this Opinion.

8. REINITIATION OF CONSULTATION

Reinitiation of consultation is required if: (1) the action is modified in a way that causes an effect on the listed species that was not previously considered in this Opinion; (2) new information or project monitoring reveals effects of the action that may affect the listed species in a way not previously considered; or, (3) a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16). NMFS will reinitiate consultation on these actions if new information becomes available, or if circumstances occur that may affect listed species or their designated critical habitats in a manner or to an extent not previously considered.

9. MAGNUSON-STEVENS ACT ESSENTIAL FISH HABITAT CONSULTATION

"Essential fish habitat" (EFH) is defined in section 3 of the Magnuson-Stevens Act (MSA) as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." NMFS interprets EFH to include aquatic areas and their associated physical, chemical and biological properties used by fish that are necessary to support a sustainable fishery and the contribution of the managed species to a healthy ecosystem.

The MSA and its implementing regulations at 50 CFR 600.920 require a Federal agency to consult with NMFS before it authorizes, funds or carries out any action that may adversely effect EFH. The purpose of consultation is to develop a conservation recommendation(s) that addresses all reasonably foreseeable adverse effects on EFH. Further, the action agency must provide a detailed, written response NMFS within 30 days after receiving an EFH conservation recommendation. The response must include measures proposed by the agency to avoid, minimize, mitigate, or offset the impact of the activity on EFH. If the response is inconsistent with NMFS' conservation recommendation the agency must explain its reasons for not following the recommendations.

The objective of this consultation is to determine whether NMFS' ESA 4(d) Rule determination regarding the submitted FMEPs for activities within the states of Oregon and Washington, is likely to adversely affect EFH. If the proposed actions are likely to adversely affect EFH, a conservation recommendation(s) will be provided.

9.1 Identification of Essential Fish Habitat

The Pacific Fishery Management Council (PFMC) is one of eight Regional Fishery Management Councils established under the Magnuson-Stevens Act. The PFMC develops and carries out fisheries management plans for Pacific coast groundfish, coastal pelagic species and salmon off the coasts of Washington, Oregon, and California. Pursuant to the MSA, the PFMC has designated freshwater and marine EFH for Pacific salmon; it includes all those streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in Washington, Oregon, Idaho, and California, except upstream of certain impassable man-made barriers (as identified by the PFMC), and longstanding, naturally impassable man-made barriers (i.e., natural waterfalls in existence for several hundred years)(PFMC 1999). Marine EFH for Pacific salmon in Oregon and Washington includes all estuarine, nearshore and marine waters within the western boundary of the U.S. Exclusive Economic Zone, 200 miles offshore.

9.2 Proposed Action and Action Area

For this EFH consultation, the proposed actions and action areas are as described in detail in the ESA consultation above. The action is NMFS' ESA 4(d) Rule determination regarding the submitted FMEPs. The proposed action area is the Columbia River Basin, including the Willamette River subbasin, and is part of the EFH for chinook and coho salmon. A more detailed description and identification of EFH for salmon is found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of the impacts on these species' EFH from the above proposed action is based on this information.

9.3 Effects of the Proposed Action

Based on information submitted by the action agencies and evaluated in NMFS' analysis in the ESA consultation above, NMFS believes that the effects of this action on EFH are likely to be within the range of effects considered in the ESA portion of this consultation. Impacts to coho EFH will be similar to those impacts identified for chinook salmon EFH and considered in this opinion.

9.4 Conclusion

Using the best scientific information available and based on its ESA consultation above, as well as the foregoing EFH sections, NMFS has determined that the proposed actions are not likely to adversely affect Pacific salmon EFH.

9.5 EFH Conservation Recommendation

NMFS has no conservation recommendations to make in this instance.

9.6 Consultation Renewal

NMFS must reinitiate EFH consultation if plans for these actions are substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for the EFH conservation recommendations (50 CFR Section 600.920(k)).

9.7 Statutory Response Requirement

Section 305(b)(4)(B) of the ESA and implementing regulations at 50 CFR section 600.920 require a Federal action agency to provide a detailed, written response to NMFS within 30 days after receiving an EFH conservation recommendation. The response must include a description of measures proposed by the agency to avoid, minimize, mitigate or offset the impact of the activity on EFH. If the response is inconsistent with a conservation recommendation from NMFS, the agency must explain its reasons for not following the recommendation.

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Appendix A. Estimated annual listed Lower Columbia River chinook salmon take levels for the Fisheries Management and Evaluation Plans.

Listed species affected: LCR Chinook Salmon **Activity: Tributary Fisheries**				
Location of hatchery activity: Tributaries to the Lower Columbia River	**Dates of activity: Year Round**			
Type of Take	**Annual Take of Listed Fish By Life Stage *(percent of run size or abundance)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)	0	0	0	0
Collect for transport b)	0	0	0	0
Capture, handle, and release c)				
Spring Chinook	0	20%	<40%	
Bright Fall Chinook	0	0	<40%	
Tule Fall Chinook	0	0	<40%	0
Capture, handle, tag/mark/tissue sample, and release d)	0	0	0	0
Removal (e.g. broodstock) e)	0	0	0	0
Intentional lethal take f)				
Tule Fall Chinook	0	0	<49%	0
Unintentional lethal take g)				
Spring Chinook	0	<2%	<10%	
Bright Fall Chinook	0	<1%	<10%	
Tule Fall Chinook	0	<1%	<10%	0
Other Take (any not identified above)	0	0	0	0

c. Juvenile take may occur in fisheries targeting resident trout and non-salmonid species. Take of adults is associated with tributary fisheries targeting returning marked hatchery adults.

f. Tributary fisheries for tule fall chinook salmon can allow the retention of naturally produced fall chinook. The 49% harvest rate includes harvest impacts from all fisheries.

g. Unintentional mortality of listed fish that are caught and released in tributary fisheries that target other species or marked hatchery chinook salmon (impacts include non-compliance).

Appendix A (cont). Estimated annual listed Lower Columbia River steelhead take levels for the Fisheries Management and Evaluation Plans.

Listed species affected: LCR Steelhead Activity: Tributary Fisheries				
Location of hatchery activity: Lower Columbia River Tributaries Dates of activity: Year Round				
Type of Take	**Annual Take of Listed Fish By Life Stage** ***(percent of run size or abundance)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)	0	0	0	0
Collect for transport b)	0	0	0	0
Capture, handle, and release c)	0	<10%	<40%	0
Capture, handle, tag/mark/tissue sample, and release d)	0	0	0	200
Removal (e.g. broodstock) e)	0	0	0	0
Intentional lethal take f)	0	0	0	0
Unintentional lethal take g)	0	<1.5%	<10%	0
Other Take (any not identified above)	0	0	0	0

c. Juvenile take may occur in fisheries targeting resident trout and non-salmonid species. Take of adults is associated with tributary fisheries targeting returning marked hatchery adults.

g. Unintentional mortality of listed fish that are caught and released in tributary fisheries that target other species or marked hatchery steelhead (impacts include non-compliance). This is maximum impact rate, actual impacts are expected to be approximately 5%.

Appendix A (cont). Estimated annual listed Columbia River Chum Salmon take levels for the Fisheries Management and Evaluation Plans.

Listed species affected: CR Chum Salmon Activity: Broodstock Collection, research, and monitoring and evaluation				
Location of hatchery activity: Lower Columbia River Tributaries Dates of activity: Year Round				
Type of Take	**Annual Take of Listed Fish By Life Stage** *(Percent of run size or abundance)*			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)	0	0	0	0
Collect for transport b)	0	0	0	0
Capture, handle, and release c)	0	<1%	<10%	0
Capture, handle, tag/mark/tissue sample, and release d)	0	0	0	0
Removal (e.g. broodstock) e)	0	0	0	0
Intentional lethal take f)	0	0	0	0
Unintentional lethal take g)	0	<1%	<5%	0
Other Take (any not identified above)	0	0	0	0

c. Juvenile take may occur in fisheries targeting resident trout and non-salmonid species. Take of adults is associated with tributary fisheries targeting returning marked hatchery adults.

g. Unintentional mortality of listed fish that are caught and released in tributary fisheries that target other species (impacts include non-compliance).

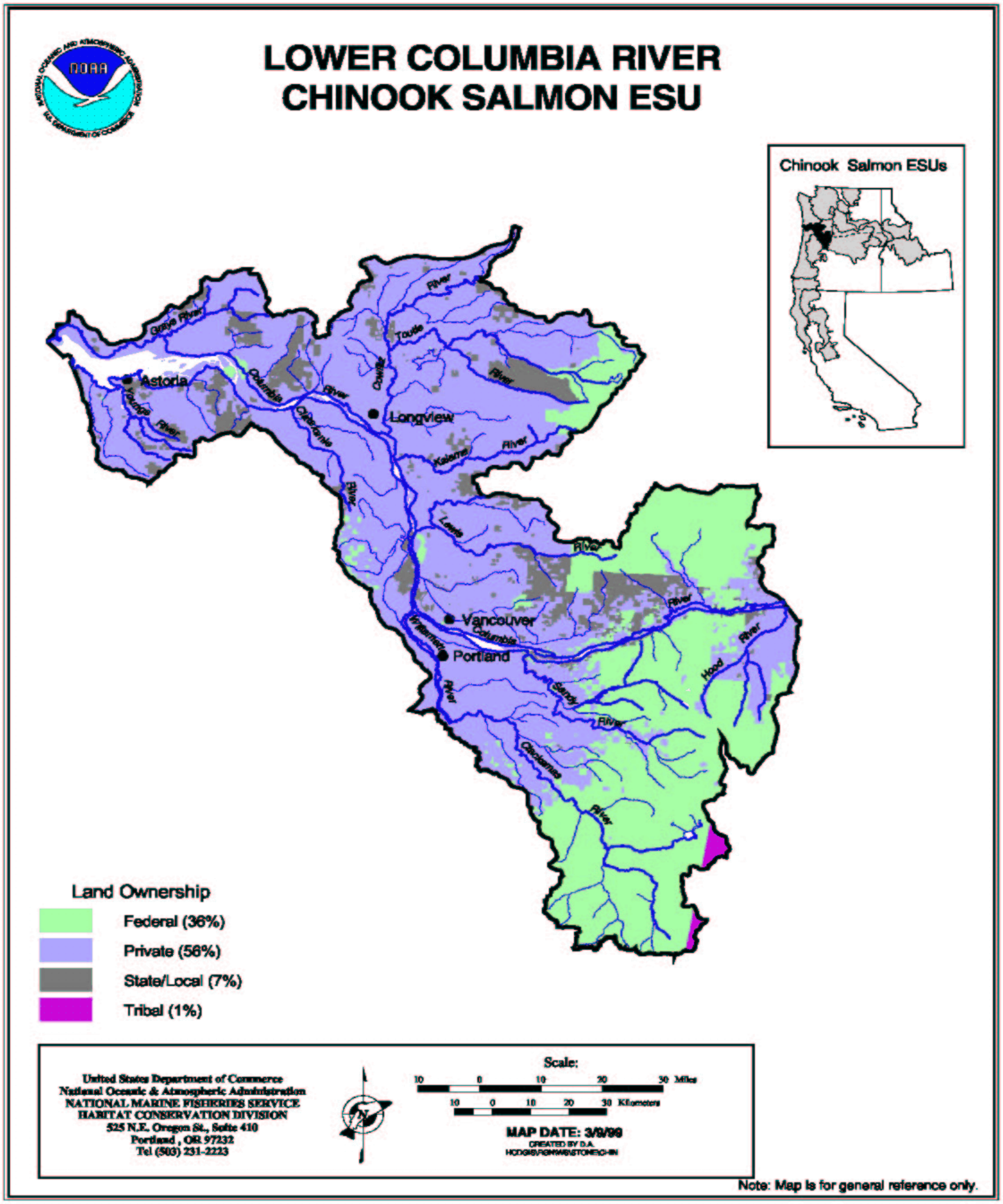

Figure 1. Action Area for Fisheries Management and Evaluation Plans and distribution of the Lower Columbia River Chinook Salmon ESU.

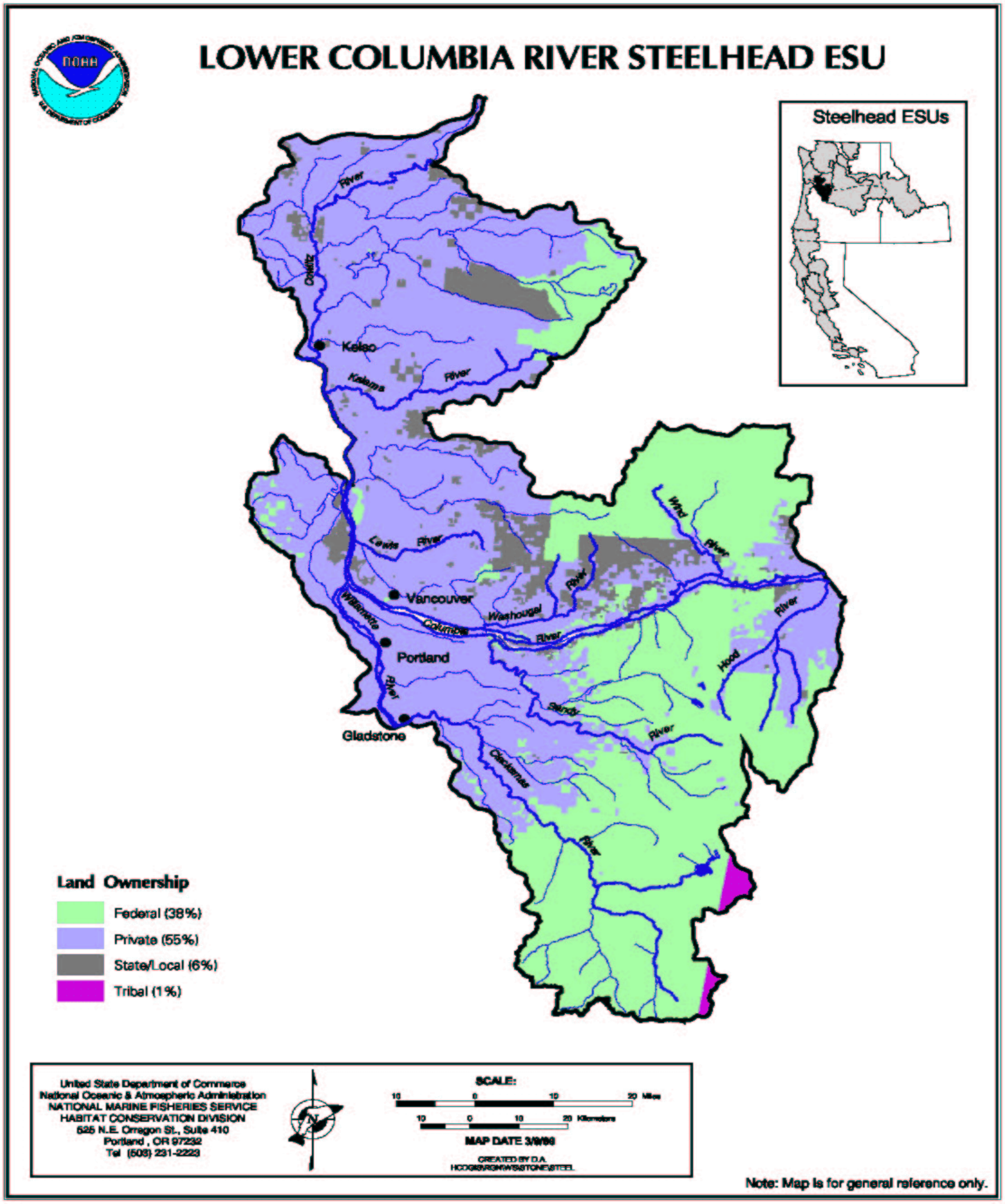

Figure 2. Distribution of the Lower Columbia River Steelhead ESU.

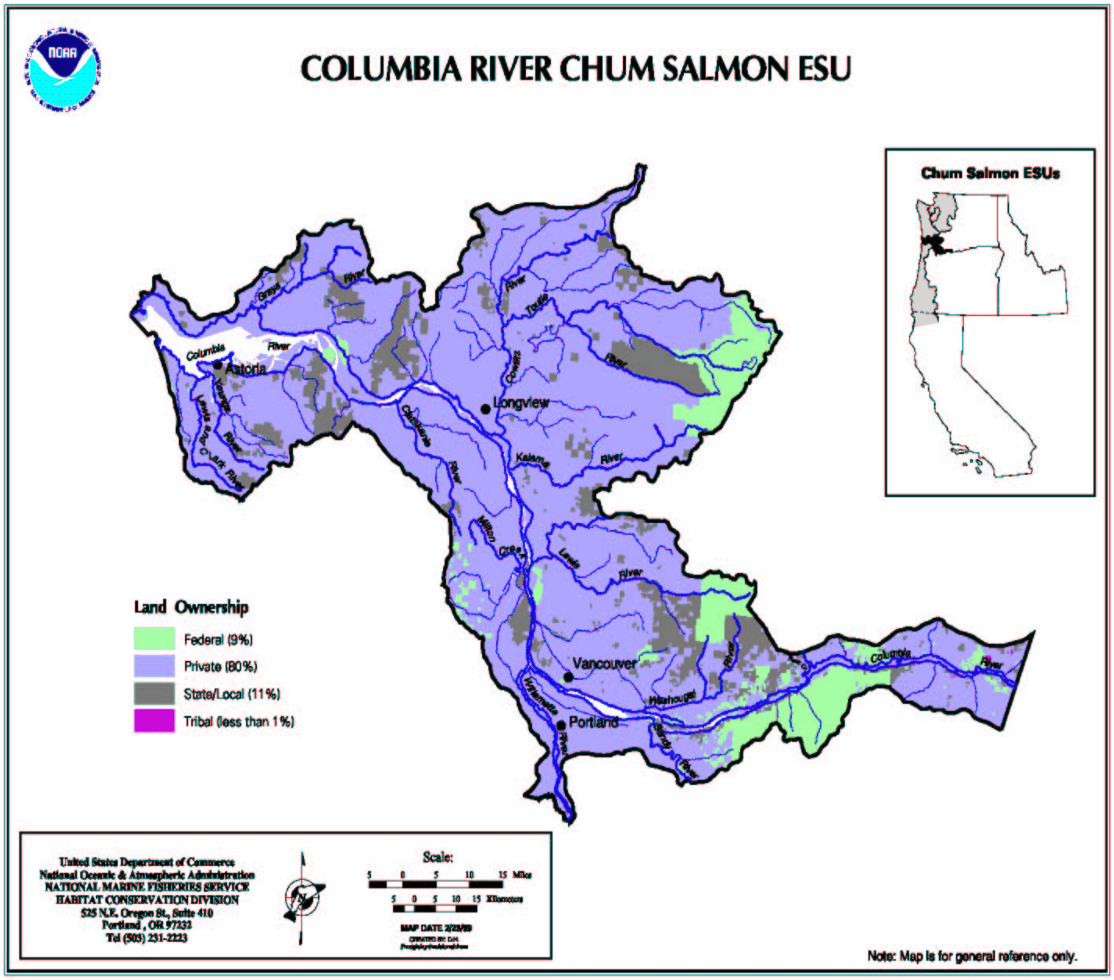

Figure 3. Distribution of Columbia River Chum Salmon ESU.